

Spindletop Center
Smith Building Renovation

655 S. 8th Street
Beaumont, Texas 77701

RFQ # 22-0005

June 13, 2022



PROJECT MANUAL

**RFQ
#22-0005**

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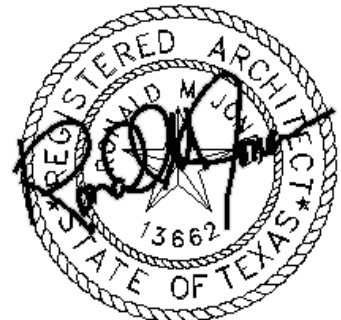
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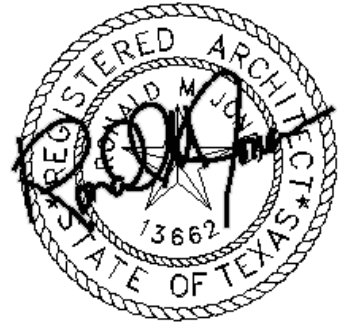
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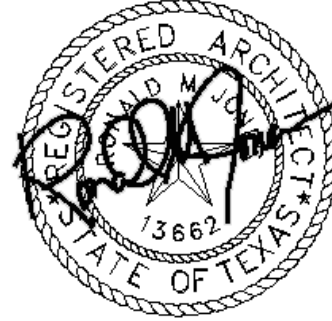
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ARCHITECT: Architectural Alliance Inc
PROJECT NO: 21198.00

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1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Ronald M. Jones, AIA .
2. 13662
3. Architectural Alliance Inc.



B. Plumbing Engineer:

1. Dustin W, Duval .
2. 117604
3. Tx PE Firm F-3297
4. M&E Consulting Inc.



C. HVAC Engineer:

1. Dustin W, Duval .
2. 117604
3. Tx Pe Firm F-3297
4. M&E Consulting



D. Electrical Engineer:

1. David Carroll .
2. 137373
3. Tx PE Firm
4. M&E Consulting



David Carroll

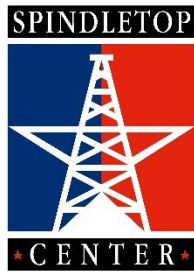
E. Building Envelope Engineer

1. Karl Schaack
2. 70234
3. Tx PE Firm F-3814
4. Price Consulting Inc.



Karl A. Schaack 6/9/22
TX PE Firm F-3814

END OF DOCUMENT 000107



SPINDLETOP CENTER
655 South 8th Street
Beaumont TX 77701
or P.O. Box 3846
Beaumont TX 77704-3846
(409) 839-1000
www.stctr.org

REQUEST FOR COMPETITIVE SEALED PROPOSAL
SPINDLETOP SMITH BUILDING RENOVATION
RFP # 22-0005

Closing Date & Time: July 7, 2022 at 2:00 PM CST

This Request for Competitive Sealed Proposal (RFP) issued by Spindletop Center is for Renovations to Smith Building located at 655 A, 8th Street, Beaumont, Texas 77701. It is the intention of Spindletop Center to hire one general contractors to achieve the quickest and best facility renovation while remaining good stewards of our funds. An organization may be awarded a contract for one or more projects/buildings. Spindletop Center reserves the right to cancel any or all projects.

To receive the specifications for the bid, contact Ronald Jones, AIA by email at rjones@architect-aia.com . Bid Documents will be sent to each respondent by email, as requested.

All proposals must be received by Spindletop Center – Facility Director’s Office at 655 S 8th Street, Beaumont, Texas before the closing date and time. Fax or email submissions will not be accepted.

Proposals received after the deadline will not be considered for the award of the contract and shall be considered void and unacceptable.

Sealed proposals must have the RFP number above on the outside of the envelopes and must comply with the Instructions for Submitting Bids included in the RFP. Failure to comply with the instructions may result in the bid being excluded from consideration.

I. PURPOSE OF SUBMISSION

Notice is hereby given that Spindletop Center will receive proposals from interested Companies for Spindletop Smith Building renovations. It is the intention of Spindletop Center to hire one general contractors to achieve the quickest and best facility renovation while remaining good stewards of our funds. Sealed proposals will be received at Spindletop Center – Facility Director’s Office, 655 S. 8th Street, Beaumont, Texas until 2:00 PM CST on July 7, 2022.

II. INFORMATION ABOUT SPINDLETOP CENTER

Spindletop Center is a community center that provides mental health, intellectual and developmental disabilities, early childhood intervention, and substance abuse services for residents of Jefferson, Chambers, Hardin, and Orange counties. It is governed by a Board of Trustees appointed by the Commissioners Courts of the counties it serves. Spindletop Center was formed in 2000 as a community mental health and IDD center established under Article 534, Texas Health and Safety Code, V.T.C.A. It is also a tax-exempt organization under Internal Revenue Code Section 501(c)(3). Spindletop does not pay Texas sales and/or use taxes, and such taxes may not be passed on as a cost to Spindletop.

III. SCOPE OF WORK

Renovation of a one-story facility, including new roof, HVAC System, Electrical, Plumbing, interior partitions, doors, floor finishes, ceilings and painting.

IV. CRITERIA FOR EVALUATION

Companies responding to the RFP will be required to provide a completed questionnaire (attached) that provides information regarding pricing, buildings, experience and reputation.

V. PRE-SUBMITTAL CONFERENCE AND COMMUNICATION WITH SPINDLETOP

A pre-submittal site visit will be held at 655 S 8th Street, Beaumont, Texas on ~~July~~ **JUNE** 16, 2022 at 10:00 AM CST.

Questions regarding this RFP may be addressed to Ronald M Jones, AIA by email at rjones@architect-aia.com no later than 10:00 AM CST on July 5, 2022. Responses to all material questions submitted will be sent via Addendum to all known plan holders, and will be issued on the project plan room website at www.architectall.com.

VI. PROPOSAL REQUIREMENTS –

Responders to the RFP are required to address the following:

1. Submit two copies of the proposal.
2. Complete Proposal Page (Attachment I) that provides:
 - 2a. A brief profile of the company and its employees, information regarding services, proposal by location, locations served, experience and reputation.
 - 2b. A list of business references including name, address, and the contact name and phone number/email address. A minimum of two (2) references is required.
3. Complete the attached Conflict of Interest Questionnaire (CIQ) Form (Attachment C)
4. A certified statement that the company is not debarred, suspended or otherwise prohibited from professional practice with any federal, state or local agency. (Attachment E)
5. Furnish any additional information considered essential to the submission.
6. Provide copy of Certificate of Insurance of general/liability and vehicle insurance coverage (Attachment G).
7. No person has the authority to verbally alter these specifications. Any changes to specifications will be made in writing by Addendum and sent to each person known to have received a bid package.

VII. GENERAL CONDITIONS

The following conditions and information applies to all submissions.

1. Right to Accept or Reject Any/Or all Proposals. Spindletop Center reserves the right to accept or reject any or all proposals submitted and to waive any informality in proposals received. Spindletop Center, also reserves the right to request additional information from proposers. The award will be made to the company(s), which, in the opinion of Spindletop Center, is the best qualified and is in the best interest of Spindletop Center.
2. Late Proposals. Proposals received after the submission deadline will remain unopened and will be considered VOID AND UNACCEPTABLE. Spindletop is not responsible for the lateness of mail, courier, etc.
3. Altering Proposal. Proposals **cannot be altered** after submission deadline. The signer of the proposal must initial any interlineations, alteration, or erasure made before the opening.
4. Addenda. Any interpretations, corrections, or changes to this Request for Proposal will be made by addenda. Sole issuing authority of addenda will be vested in Spindletop Center. Addenda will be emailed to all parties that are known to have received a copy of the Request for Proposal. Addenda will also be placed on Spindletop's and Architect's website.

5. Oral Interviews. Oral interviews may be required.
6. Proposals Retained. All proposals submitted become the exclusive property of Spindletop Center.
7. Changes. No oral statement of any person shall modify or otherwise change or affect the terms, conditions, plans and/or specifications stated in the various proposal packages and/or proposal instructions/requirements.
8. Ethics. The proposer shall not accept or offer gifts or anything of value, nor enter into any business arrangement with any employee, official or agent of Spindletop.
9. Minimum Standards for Responsible Proposer. A prospective proposer must affirmatively demonstrate proposer's responsibility. A prospective proposer must meet the following requirements:
 - a. Be able to comply with the required or proposed time schedule;
 - b. Have a satisfactory record of performance; and
 - c. Be otherwise qualified and eligible to receive an award.
10. Rights to Request Additional Information. Spindletop Center may request representation and other information sufficient to determine proposer's ability to meet these minimum standards listed above.
11. References. Spindletop requires proposer to furnish, with this proposal, a list of at least two (2) references where like projects have been completed by the organization. Include the name of the business, address, contact name and telephone number/email.
12. Documentation. Proposer shall provide with this response, all documentation required by this proposal. Failure to provide this information may result in rejection of the proposal.
13. Silence of Specifications. The apparent silence of these specifications as to any detail or to the apparent omission from it of a detailed description concerning any point shall be regarded as meaning that only the best practices are to prevail. All interpretations of these specifications shall be made on the basis of this statement.
14. Legibility. Proposals **must be** legible and of a quality that can be reproduced.
15. Vendor Proposal and Demonstration Costs. All costs incurred by the vendor associated with preparing proposal responses and demonstrating products or services shall not be charge to Spindletop.
16. Proposers' Eligibility: Proposer must be in good standing with any state or federal agency from which the Proposer receives funds. If a state or federal agency has terminated a Proposer contract within the last twelve (12) months for deficiencies in performance of the contract, that Proposer is not eligible to submit a proposal to this RFP. Additionally, any Proposer who has been debarred, suspended, or otherwise excluded from or is ineligible for participation in federal assistance programs is not

eligible to submit a proposal. Proposer who have not repaid funds owed to the Agency are not eligible to submit a bid.

17. Access to Spindletop Center Facilities/Observance of Spindletop Center Regulations: For on-site visits, employees, representatives, or subcontractors of the Proposer shall have reasonable and free access to only those areas of Spindletop Center facilities and centers that are necessary to perform services under the contract and shall have no right of access to any other areas of the facility or center. All site regulations will be observed including but not limited to patient/client confidentiality, parking and security regulations, smoking, and carrying weapons are prohibited. All representatives of Proposer shall notify Spindletop Center designee, at each site, that they are on campus, prior to beginning work.
18. Commitments: The parties hereto recognize and agree that Spindletop Center needs may from time to time fluctuate widely. Spindletop Center makes no representation, guarantee, or commitment that Spindletop Center will purchase any minimum quantity of services or products under the contract.
19. Spindletop Center will not be bound to act by any previous communication with proposers, other than this RFP and State Law.
20. Confidentiality: All information submitted to Spindletop Center in response to this RFP is subject to disclosure under the Texas Public Information Act unless the Office of the Attorney General (OAG) finds such information is excepted from disclosure under the Act.
21. Spindletop Center shall be the sole judge of the interests of the State and Spindletop Center.
22. Proposer shall disclose any employment or business relationship proposer may have with a Spindletop Board Trustee or executive management team member listed in Exhibit B. If no relationship exists, a statement must be submitted with the proposal indicating the proposer has no conflict of interest with any of the Trustees or executive management team Attachment C.
23. Sales Tax. Spindletop Center is, by statute, exempt from State sales tax and Federal excise tax.
24. Time of Award. Award will be determined at a Board of Trustees meeting to be announced.
25. Contract Award. Awarding of the contract will be made by Spindletop Center's Board of Trustees. The project will begin upon final acceptance of the completed proposal by Spindletop Center.
26. Spindletop Center will not discriminate against any Respondent because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by the laws of the state of Texas relating to discrimination in employment. Further,

Spindletop Center will not discriminate against small and minority businesses or faith-based organizations.

27. Contractor understands that Spindletop Center will comply with the Texas Public Information Act (Chapter 442 of the Texas Government Code) as interpreted by judicial rulings and opinions of the Attorney General of the State of Texas. Information, documentation, and other material in connection with this Response or any resulting contract may be subject to public disclosure pursuant to the Texas Public Information Act. In accordance with Section 2252.907 of the Texas Government Code, Contractor is required to make any information created or exchanged with the State pursuant to the contract, and not otherwise excepted from disclosure under the Texas Public Information Act, available in a format that is accessible by the public at no additional charge to the State.
28. Contractor represents and warrants that it is not aware of and has received no notice of any court or governmental agency actions, proceedings or investigations, etc., pending or threatened against Contractor or any of the individuals or entities included in the Contract within the five (5) calendar years immediately preceding the submission of the Contract that would or could impair Contractor's performance under the contract, relate to the solicited or similar goods or services, or otherwise be relevant to Spindletop Center's consideration of the Response. If Respondent is unable to make the preceding representation and warranty, then Respondent instead represents and warrants that it has included as a detailed attachment in its Response a complete disclosure of any such court or governmental agency actions, proceedings or investigations, etc. that would or could impair Contractor's performance under the contract, relate to the solicited or similar goods or services or otherwise be relevant to Center's consideration of the Response. In addition, Respondent represents and warrants that it shall notify center in writing within five (5) business days of any changes to the representations or warranties in this clause and understands that failure to so timely update Spindletop Center shall constitute breach of contract and may result in immediate termination of the contract.
29. Any terms and conditions attached to a Response will not be considered unless specifically referred to in the Response.
30. Respondent certifies that if a Texas address is shown as the address of the Respondent on this Response, Respondent qualifies as a Texas Bidder as defined in Section 2155.444(c) of the Texas Government Code.
31. Should the Respondent not meet the requirements of any executed agreement with Spindletop Center, Spindletop may terminate the agreement within thirty (30) days with written notice. In this case, Spindletop may award the remainder of the agreement to the next best vendor.
32. This RFP and subsequent agreement(s) are made contingent upon the continuation of federally funded programs, or the continued availability of state or local funds to cover the full term and cost. This agreement is subject to termination, without penalty, either in whole or in part, if funds are not appropriated or are discontinued.

In this instance, Spindletop Center may cancel the agreement by giving thirty (30) days written notice to the respondent.

The following provisions may apply to the contract with the individual/company:

1. Contract. Spindletop Center reserves the right to negotiate a contract with the selected proposer. This proposal accepted by Spindletop Center, shall constitute a contract equally binding between the successful proposer and Spindletop Center. No different or additional terms will become part of this contract.
2. Indemnification. The proposer will indemnify Spindletop Center against any claims, demands, and judgments of sums of money to any party accruing against Spindletop for the loss of life or injury or damage to person or property growing out of or resulting from this contract.
3. Termination for Default. Spindletop Center reserves the right to enforce the performance of this contract in any manner prescribed by law or deemed to be in the best interest of Spindletop in the event of breach of default of this contract. Non-performance of the proposer in terms of specifications shall be a basis for termination and non-payment of the services which are unsatisfactory. Vendors will be given a reasonable opportunity before termination to correct deficiencies. This, however, shall in no way be construed as negating the basis for termination of non-performance.
4. Independent Contractor. The Proposer will be considered an independent contractor and not an employee of Spindletop for any purpose. Spindletop Center will not withhold or pay on behalf of Proposer any sums for income tax, unemployment insurance, social security, or any other withholding, or make available to the proposer any of the benefits, including workers' compensation insurance coverage, afforded to employees of Spindletop Center. All such benefits, if any, are the sole responsibility of the proposer.

If Proposer is a corporation and is or becomes delinquent in the payment of its Texas franchise tax, then payments to the Proposer due under this Agreement shall be withheld until the delinquency is remedied.

5. AIDS/HIV Work Place Guidelines. Proposer agrees to adopt and implement AIDS/HIV workplace guidelines similar to those adopted by the State and/or its successor, and AIDS/HIV confidentiality guidelines, consistent with state and federal law.
6. Immigration Reform and Control Act. Proposer agrees to maintain appropriate identification and employment eligibility documents to meet requirements of the Immigration Reform and Control Act of 1986.
7. Permits, License, and Certifications. Proposer shall maintain as current and in good standing, any permits, licenses, or certification required by law to provide services pursuant to this contract.

8. Disclosure. Proposer agrees to disclose to Spindletop Center if it or any of its employees or its agents rendering services to an individual pursuant to this Contract:
 - a. Is currently barred from the award of a federal, state or county contract, or if such occurs anytime during the term of this Contract;
 - b. Has been convicted of a criminal offense related to any county, state or federally funded program;
 - c. Is placed on "vendor hold" status for any county, state, or federally funded program; or,
 - d. Is delinquent in the payment of any state or federal tax.
9. Insurance. Proposer agrees to maintain at its sole cost and expense policies of general/liability and vehicle insurance coverage in order to insure proposer and Spindletop against any claim for damages arising in connection with proposer's responsibilities under the contract.
10. Certification of Child Support Payment Obligor. Under Section 231.006 (Texas Family Code related to child support), a Proposer is considered ineligible to receive payments from Spindletop in the event the contractor is past due on child support payments.
11. Boycotting Israel. Pursuant to Texas Government Code Chapter 2270, the Proposer will verify that it (1) does not boycott Israel, and (2) will not boycott Israel during the term of the contract. Boycotting Israel includes refusing to deal with, terminating business activities with, or otherwise taking any action intended to penalize, inflict economic hard on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or with an Israeli-controlled territory but does not include an action made for ordinary business purposes.
12. Certification Regarding Procurement: Provider certifies that it has not offered, given or agreed to give anything of value to an employee of Local Authority in connection with procurement of this Agreement.

VIII. INSTRUCTIONS FOR SUBMISSION OF BID –

All bids in response to this Request for Proposal must meet the following conditions to be considered:

1. Submit two (2) copies of the proposal.
2. Proposal must include a cover letter clearly stating the name of the proposer, mailing address, email address, and telephone number of the proposer's representative
3. Proposer shall submit the proposal in a sealed package, clearly marked on the front of the package **Request for Proposal for *Spindletop Smith Building Renovation* – RFP # 22-0005**
4. All proposals must be received at **Spindletop Center – Facility Director's Office at 655 S 8th Street, Beaumont, Texas by no later than 2:00 PM on July 7, 2022.** Proposals submitted prior to this time and date may be modified provided such

modifications are sealed and received at the same address prior to the date and time set for submissions of proposal. Any proposals or modifications received after this time shall not be considered.

5. All proposals become the property of Spindletop upon receipt and will not be returned. Any information deemed to be confidential by proposer should be clearly noted on the page(s) where confidential information is contained, however, Spindletop Center cannot guarantee that it will not be compelled to disclose all or part of any public record.

IX. CALENDAR OF EVENTS -

June 10, 2022	Legal notice of RFP begins
June 13, 2022	Issuance of RFP specifications to Proposers & placed on Spindletop Center’s website at www.stctr.org
June 16, 2022	Pre-Proposal meeting held at project site 10:00 AM.
July 7, 2022	Proposals due at Spindletop by 2:00 p.m. CST to Spindletop Facility Manager’s Office
July 11 - 14, 2022	Proposal evaluation, interviews (if required), questions/negotiations
July 15, 2022	Recommendation to Board of Trustees’
July 28, 2022	Notification of bid award, if appropriate

X. EXHIBITS AND ATTACHMENTS –

Exhibit A:	Bid Documents consisting of drawing and Project Manual —
Exhibit B:	List of Board of Trustees and Executive Management Team
Attachment A:	Cover Sheet
Attachment B:	Assurances Document
Attachment C:	Conflict of Interest Questionnaire
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EXHIBIT A - LIST OF SPECIFICATION SECTIONS

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PROCUREMENT AND CONTRACTING DOCUMENTS GROUP

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002213	SUPPLEMENTARY INSTRUCTIONS TO BIDDERS
004113	PROPOSAL FORM - STIPULATED SUM
004313	BID BOND AIA A310 - 2010
005200	AIA A101-2017 Standard Agreement between Owner and Contractor
005200.01	AIA A101-2017 EXHIBIT A INSURANCE AND BONDS
006113.13	AIA A312-2010 PERFORMANCE BOND
006113.16	AIA A312 -2010 PAYMENT BOND
007000	AIA A201-2007 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

SPECIFICATIONS GROUP

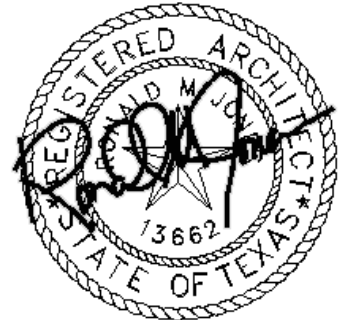
General Requirements Subgroup

DIVISION 01	- GENERAL REQUIREMENTS
011000	SUMMARY
012100	ALLOWANCES
012500	SUBSTITUTION PROCEDURES
012900	PAYMENT PROCEDURES
013200	CONSTRUCTION PROGRESS DOCUMENTATION
013300	SUBMITTAL PROCEDURES
015000	TEMPORARY FACILITIES AND CONTROLS
017700	CLOSEOUT PROCEDURES
017823	OPERATION AND MAINTENANCE DATA
017839	PROJECT RECORD DOCUMENTS

Facility Construction Subgroup

DIVISION 02	- EXISTING CONDITIONS
0240000	MINOR DEMOLITION AND RENOVATION WORK
024119	SELECTIVE DEMOLITION

DIVISION 03	- CONCRETE
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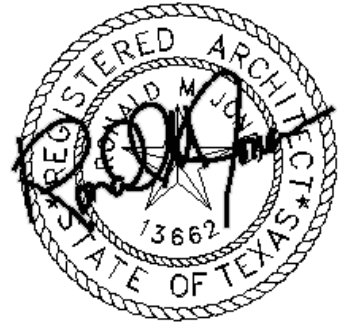
031000 CONCRETE FORMING AND ACCESSORIES
032000 CONCRETE REINFORCING
033000 CAST-IN-PLACE CONCRETE

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

061000 ROUGH CARPENTRY
064116 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

072100 THERMAL INSULATION
072200 ROOF BOARD INSULATION
075400 THERMOPLASTIC SINGLE PLY ROOF MEMBRANE
072600 VAPOR RETARDERS
076200 SHEET METAL FLASHING AND TRIM
079200 JOINT SEALANTS



DIVISION 08 - OPENINGS

081113 HOLLOW METAL DOORS AND FRAMES
081416 FLUSH WOOD DOORS
084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
087100 DOOR HARDWARE
088000 GLAZING

DIVISION 09 - FINISHES

092900 GYPSUM BOARD
093013 CERAMIC TILING
095123 ACOUSTICAL TILE CEILINGS
096513 RESILIENT BASE AND ACCESSORIES
096519 RESILIENT TILE FLOORING
096726 QUARTZ FLOORING
096813 TILE CARPETING
099123 INTERIOR PAINTING

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102113.17 PHENOLIC -CORE TOILET COMPARTMENTS
102600 WALL AND DOOR PROTECTION
102800 TOILET, BATH, AND LAUNDRY ACCESSORIES
104413 FIRE PROTECTION CABINETS
104416 FIRE EXTINGUISHERS

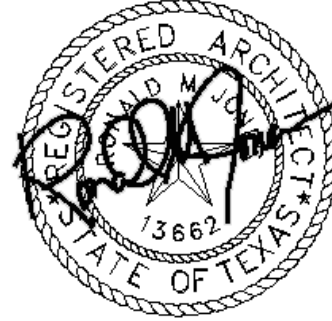
DIVISION 11 - EQUIPMENT

113013 RESIDENTIAL APPLIANCES

Site and Infrastructure Subgroup

DIVISION 31 - EARTHWORK
313116 TERMITE CONTROL

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321313 CONCRETE PAVING
321723 PAVEMENT MARKINGS



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ARCHITECT: Architectural Alliance Inc
PROJECT NO: 21198.00

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DIVISION 22 - PLUMBING

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22 05 23 General Duty Valves For Plumbing
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26 43 13	Surge Protection Device for Service Entrance and Branch Panels
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EXHIBIT B

BOARD OF TRUSTEES

Frank Coffin, Chairman
Rebecca Ford, Vice Chair
Gaye Lokey, Secretary
Gus Harris
Brian Hawthorne
Dolores Sennette
Mike Marion
Dr. Dana Johnson
Edreauanna Fowler
Sheriff Zena Stephens, Ex Officio
Sheriff Mark Davis, Ex Officio

EXECUTIVE MANAGEMENT TEAM

Holly Borel, Chief Executive Officer
Denise LeBlanc, Chief Financial Officer
Dr. Scott Strang, Chief Clinical Officer
Lisa Gibbs, Chief Intellectual and Development Disabilities (IDD) Officer
Creslyn Foster, Chief Human Resources Officer
Bryan Gauthier, Chief Information Officer

ATTACHMENT A

COVER SHEET

Name of Company	
Company Mailing Address	
Company Telephone Number	
Name of Authorized Representative	
Title of Authorized Representative	
Representative’s Telephone Number	
Representative’s Email Address	

Is Bidder a member of one of the following purchasing co-ops?

Buy Board		TxMAS	
Texas SmartBuy		Region 5	
Other		Other	

Is Bidder considered a Historically Underutilized Business (HUB)?

No		Yes		Qualifying factor:	
----	--	-----	--	--------------------	--

Is Bidder considered a Small Business (less than \$1,000,000 annual receipts or 100 employees)?

No		Yes	
----	--	-----	--

The person signing below certifies they are entitled to represent the bidder, empowered to submit the bid, and authorized to sign a contract. The signer also certifies all information submitted with this bid is true and correct.

 Name
 Printed Name:
 Title:

 Date

ATTACHMENT B

ASSURANCES DOCUMENT

Bidder assures the following:

1. All exhibits and attachments to the RFP as distributed by Spindletop Center and designated by the checklist have been received.
2. No attempt has been or will be made by the Bidder to induce any person or firm to submit or not to submit a Bid, unless so described in its Bid.
3. The Bidder does not discriminate in its services or employment practices on the basis of race, color, genetic information, religion, sex, sexual orientation, national origin, disability, veteran status, or age.
4. All cost and pricing information is reflected in the RFP response documents or attachments.
5. Bidder accepts the terms, conditions, criteria, and requirements set forth in the RFP.
6. Bidder accepts Spindletop Center's right to cancel the RFP at any time prior to Contract award.
7. Bidder accepts Spindletop Center's right to alter the timetables for procurement that are set forth in the RFP.
8. The Bid submitted by the Bidder has been arrived at independently without consultation, communication, or agreement for the purpose of restricting competition.
9. Unless otherwise required by law, the information in the Bid submitted by the Bidder has not been knowingly disclosed by the Bidder to any other Bidder prior to the notice of intent to award.
10. No claim will be made for payment to cover costs incurred in the preparation of the submission of the Bid or any other associated costs.
11. Spindletop Center has the right to complete background checks and verify information.
12. The individual(s) signing this document and any contract awarded to Bidder is authorized to legally bind the Bidder.

ATTACHMENT B

ASSURANCES DOCUMENT - CONTINUED

13. No employee of Spindletop Center, and no member of Spindletop Center’s Board of Trustees will directly or indirectly receive any pecuniary interest from an award of the proposed Contract to Bidder. If the Bidder is unable to make the affirmation, then the Bidder must disclose any knowledge of such interests. See Attachment C.
14. Bidder is not currently held in abeyance or barred from the award of a federal or state contract.
15. Bidder has not filed for bankruptcy within the past five (5) years
16. Bidder is not currently in the process of filing for bankruptcy.
17. Bidder is not currently delinquent in its payments of any franchise tax or state tax owed to the state of Texas, pursuant to Texas Business Corporation Act, Texas Civil Statutes) Article 2.45.
18. Bidder shall disclose whether any of the directors or personnel of Bidder have either been an employee or trustee of Spindletop Center within the past three (3) years preceding the date of submission of the Bid. If such employment has existed, or a term of office serviced, the Bidder shall state in writing the nature and time of the affiliations as defined. See Attachment C.
19. Bidder shall identify in writing any trustee or employee of Spindletop Center who has a financial interest in Bidder or who is related within the second degree by consanguinity or affinity to a person having such financial interest. Such disclosure shall include a complete statement of the nature of such financial interest and the relationship, if applicable. See Attachment C.
20. No former employee or officer of Spindletop Center directly or indirectly aided or attempted to aid in procurement of Bidder’s service.
21. Bidder shall disclose in writing the name of every Spindletop Center employee and/or member of Spindletop Center’s Board of Trustees with whom Bidder is doing business or has done business during the 365-day period immediately prior to the date on which the Bid is due. Failure to include such a disclosure will be a binding representation by Bidder that the natural person executing the Bid has no knowledge of any key persons with whom Bidder is doing business or has done business during the 365-day period prior to the immediate date on which the Bid is due. See Attachment C.

ATTACHMENT B

ASSURANCES DOCUMENT - CONTINUED

- 22. Pursuant to Texas family Code Section 231.006, the Bidder represents and warrants that it is not delinquent in the payment of child support. Bidder acknowledges that Spindletop Center may terminate this contract and withhold payment if child support becomes delinquent.

- 23. Pursuant to Texas Government Code Chapter 2270, the Bidder verifies that it (1) does not boycott Israel, and (2) will not boycott Israel during the term of the contract. Boycotting Israel includes refusing to deal with, terminating business activities with, or otherwise taking any action intended to penalize, inflict economic hard on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or with an Israeli-controlled territory but does not include an action made for ordinary business purposes.

Signature of Bidder’s Authorized Representative Date _____

Printed Name

Title

Company Name

ATTACHMENT C

CONFLICT OF INTEREST QUESTIONNAIRE – PAGE 1

CONFLICT OF INTEREST QUESTIONNAIRE For vendor doing business with local governmental entity		FORM CIQ
<p>This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.</p> <p>This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).</p> <p>By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.</p> <p>A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.</p>	OFFICE USE ONLY Date Received	
<p>1 Name of vendor who has a business relationship with local governmental entity.</p>		
<p>2 <input type="checkbox"/> Check this box if you are filing an update to a previously filed questionnaire. (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)</p>		
<p>3 Name of local government officer about whom the information is being disclosed.</p> <p style="text-align: center;">_____</p> <p style="text-align: center;">Name of Officer</p>		
<p>4 Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.</p> <p style="margin-left: 40px;">A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?</p> <p style="margin-left: 80px;"> <input type="checkbox"/> Yes <input type="checkbox"/> No </p> <p style="margin-left: 40px;">B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?</p> <p style="margin-left: 80px;"> <input type="checkbox"/> Yes <input type="checkbox"/> No </p>		
<p>5 Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.</p>		
<p>6 <input type="checkbox"/> Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).</p>		
<p>7</p> <p style="text-align: center;"> _____ Signature of vendor doing business with the governmental entity </p> <p style="text-align: right; margin-right: 100px;"> _____ Date </p>		

ATTACHMENT C

CONFLICT OF INTEREST QUESTIONNAIRE – PAGE 2

**CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity**

A complete copy of Chapter 176 of the Local Government Code may be found at <http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm>. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

- (A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;
- (B) a transaction conducted at a price and subject to terms available to the public; or
- (C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds \$2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed;
or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than \$100 in the 12-month period preceding the date the officer becomes aware that:

- (i) a contract between the local governmental entity and vendor has been executed; or
- (ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

ATTACHMENT D

LOBBYING CERTIFICATION

The undersigned certifies, to the best of their knowledge and belief that:

1. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or an employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with the awarding of any federal contract, the making of any federal grant, the making of any federal loan, the entering into any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal contract, grant, loan, or cooperative agreement.
2. If any funds other than federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.
3. The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontracts, sub grants, and contracts under grants, loans and cooperative agreements) and that all sub recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering in to this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Signature of Authorized Individual

Date

Print Name of Authorized Individual

Title

EXHIBIT E

**CERTIFICATION
REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY
AND VOLUNTARY EXCLUSION FOR COVERED CONTRACTS AND AGREEMENTS**

Executive Order 12549, CFR part 180, requires **Spindletop Center (Center)** to screen each covered potential contractor/vendor to determine whether each has a right to obtain a contract in accordance with federal regulations on debarment, suspension, ineligibility, and voluntary exclusion. Each covered contractor/vendor must also screen each of its covered subcontractors/vendors. In this certification "contractor/vendor" refers to both contractor/vendor and subcontractor/sub vendor; "contract/agreement" refers to both contract/agreement and subcontract/sub agreement.

By signing and submitting this certification the potential contractor/vendor accepts the following terms:

1. The certification herein below is a material representation of fact upon which reliance was placed when this contract/agreement was entered into. If it is later determined that the potential contractor/vendor knowingly rendered an erroneous certification, in addition to other remedies available to the federal government, the center may pursue available remedies, including suspension and/or debarment.
2. The potential contractor/vendor shall provide immediate written notice to the person to which this certification is submitted if at any time the potential contractor/vendor learns that the certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
3. The words "covered contract," "debarred," "suspended," "ineligible," "participant," "person," "principal," "proposal," and "voluntarily excluded," as used in this certification have meanings based upon materials in the Definitions and Coverage sections of federal rules implementing Executive Order 12549.
4. The potential contractor/vendor agrees by submitting this certification that, should the proposed covered contract/agreement be entered into, it shall not knowingly enter into any subcontract with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the Center, as applicable.

Do you have or do you anticipate having subcontractors'/sub vendors under this proposed contract? _____ YES _____ NO

EXHIBIT E

**CERTIFICATION
REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY
AND VOLUNTARY EXCLUSION FOR COVERED CONTRACTS AND AGREEMENTS**

1. The potential contractor/vendor further agrees by submitting this certification that it will include this certification titled "Certification Regarding Debarment, Suspension, Ineligibility, and Voluntary Exclusion for Covered Contracts and Agreements" without modification, in all covered subcontracts and in solicitations for all covered subcontracts.
2. A contractor/vendor may rely upon a certification of a potential subcontractor/sub vendor that it is not debarred, suspended, ineligible, or voluntarily excluded from the covered contract/agreement, unless it knows that the certification is erroneous. A contractor/vendor must, at a minimum, obtain certifications from its covered subcontractors/ sub vendors upon each subcontract's/sub agreement's initiation and upon each renewal
3. Nothing contained in all the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this certification document. The knowledge and information of a contractor/vendor is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
4. Except for contracts/agreements authorized under paragraph 4 of these terms, if a contractor/vendor in a covered contract/agreement knowingly enters into a covered subcontract/sub agreement with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in the transaction, in addition to other remedies available to the federal government or Center may pursue available remedies, including suspension and/or debarment.

Indicate which statement applies to the covered potential contractor/vendor:

_____ The potential contractor/vendor certifies, by submission of this certification, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this contract/agreement by any federal department or agency or by the State of Texas.

_____ The potential contractor/vendor is unable to certify to one or more of the terms in this certification. In this instance, the potential contractor/vendor must attach an explanation for each of the above terms to which he is unable to make certification. Attach the explanation(s) to this certification.

EXHIBIT E

CERTIFICATION
REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY
AND VOLUNTARY EXCLUSION FOR COVERED CONTRACTS AND AGREEMENTS

NAME OF POTENTIAL CONTRACTOR/GRANTEE

VENDOR ID NO./FEDERAL EMPLOYER'S ID NO. _____

DUNS Number: _____ CAGE Code (*if applicable*): _____

Signature of Authorized Representative

Printed Name of Authorized Representative

Date _____

THIS CERTIFICATION IS FOR FY 2022
September 1, 2021 to August 31, 2022

ATTACHMENT F

Form W-9 (Rev. October 2018) Department of the Treasury Internal Revenue Service	<h2 style="margin:0;">Request for Taxpayer Identification Number and Certification</h2> <p style="margin:0; color: blue;">▶ Go to www.irs.gov/FormW9 for instructions and the latest information.</p>	Give Form to the requester. Do not send to the IRS.																																																																																		
1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.																																																																																				
2 Business name/disregarded entity name, if different from above																																																																																				
Print or type. See Specific Instructions on page 3.	3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only one of the following seven boxes. <input type="checkbox"/> Individual/sole proprietor or single-member LLC <input type="checkbox"/> Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ▶ _____ Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is not disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner. <input type="checkbox"/> Other (see instructions) ▶ _____	4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3): Exempt payee code (if any) _____ Exemption from FATCA reporting code (if any) _____ <small>(Applies to accounts maintained outside the U.S.)</small>																																																																																		
5 Address (number, street, and apt. or suite no.) See instructions.		Requester's name and address (optional)																																																																																		
6 City, state, and ZIP code																																																																																				
7 List account number(s) here (optional)																																																																																				
<h3>Part I Taxpayer Identification Number (TIN)</h3> <p>Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see <i>How to get a TIN</i>, later.</p> <p>Note: If the account is in more than one name, see the instructions for line 1. Also see <i>What Name and Number To Give the Requester</i> for guidelines on whose number to enter.</p>																																																																																				
		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td colspan="10" style="text-align: center; font-size: small;">Social security number</td> </tr> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td colspan="10" style="text-align: center;">-</td> </tr> <tr> <td colspan="10" style="text-align: center;">-</td> </tr> <tr> <td colspan="10" style="text-align: center;">or</td> </tr> <tr> <td colspan="10" style="text-align: center; font-size: small;">Employer identification number</td> </tr> <tr> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> <td style="width: 20px; height: 20px;"></td> </tr> <tr> <td colspan="10" style="text-align: center;">-</td> </tr> </table>	Social security number																					-										-										or										Employer identification number																					-									
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<h3>Part II Certification</h3> <p>Under penalties of perjury, I certify that:</p> <ol style="list-style-type: none"> The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and I am a U.S. citizen or other U.S. person (defined below); and The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct. <p>Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.</p>																																																																																				
Sign Here	Signature of U.S. person ▶ _____	Date ▶ _____																																																																																		
<h3>General Instructions</h3> <p>Section references are to the Internal Revenue Code unless otherwise noted.</p> <p>Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to www.irs.gov/FormW9.</p> <h4>Purpose of Form</h4> <p>An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.</p> <ul style="list-style-type: none"> • Form 1099-INT (interest earned or paid) • Form 1099-DIV (dividends, including those from stocks or mutual funds) • Form 1099-MISC (various types of income, prizes, awards, or gross proceeds) • Form 1099-B (stock or mutual fund sales and certain other transactions by brokers) • Form 1099-S (proceeds from real estate transactions) • Form 1099-K (merchant card and third party network transactions) • Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition) • Form 1099-C (canceled debt) • Form 1099-A (acquisition or abandonment of secured property) <p>Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.</p> <p><i>If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, later.</i></p>																																																																																				
Cat. No. 10231X		Form W-9 (Rev. 10-2018)																																																																																		

EXHIBIT G

CERTIFICATE OF INSURANCE

Copy of the company Certificate of Insurance of General Liability and Vehicle Insurance coverage is attached.

If a Certificate of Insurance is unavailable, please explain why:

ATTACHMENT H

REFERENCES

Reference #1

Company Name	
Company Representative	
Company Address	
Representative’s Phone Number	
Representative’s Email Address	
Length of working relationship	

Reference #2

Company Name	
Company Representative	
Company Address	
Representative’s Phone Number	
Representative’s Email Address	
Length of working relationship	

Reference #3

Company Name	
Company Representative	
Company Address	
Representative’s Phone Number	
Representative’s Email Address	
Length of working relationship	

ATTACHMENT I

**PROPOSAL FORM
SEE SECTION 004113**

End Section 00 11 19

**ATTACHMENT J
GRADING CRITERIA**

Spindletop Smith Building Renovation

General Contractor:
COMPETITIVE SEALED PROPOSAL SCORE CHART

1	Proposed Price	0-50	Total Score
2	Company History, experience, reputation	0-15	Total Score
3	Proposed Schedule / Timeline	0-20	Total Score
4	Subcontractors	0-15	Total Score

<p>Notes: Spindletop Center will select a vendor whose goods or services provide the best value for the organization based on the above criteria, the vendor with the highest score will be granted the job.</p>
--

DOCUMENT 002113 - INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS / REQUEST FOR COMPETITIVE SEALED PROPOSALS

- A. AIA Document A701, "Instructions to Bidders," is hereby incorporated into the Procurement and Contracting Requirements by reference.
 - 1. A copy of AIA Document A701, "Instructions to Bidders," is bound in this Project Manual.

END OF DOCUMENT 002113

DRAFT AIA® Document A701™ - 2018

Instructions to Bidders

for the following Project:

(Name, location, and detailed description)

«SMITH BUILDING RENOVATION»
«655 S. 8th Street »
«Beaumont, Texas 77701 »

THE OWNER:

(Name, legal status, address, and other information)

«Spindletop Center »« »
«688 S. 8th Street »
«Beaumont, Texas 77701 »
« »

THE ARCHITECT:

(Name, legal status, address, and other information)

«Architectural Alliance Incorporated »« »
«350 Pine Street, Suite 720 »
«Beaumont, Texas 77701 »
« »

TABLE OF ARTICLES

- 1 DEFINITIONS
- 2 BIDDER'S REPRESENTATIONS
- 3 BIDDING DOCUMENTS
- 4 BIDDING PROCEDURES
- 5 CONSIDERATION OF PROPOSALS
- 6 POST-PROPOSAL INFORMATION
- 7 PERFORMANCE BOND AND PAYMENT BOND
- 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™-2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.



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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation for Competitive Sealed Proposal, Instructions to Bidders, supplementary instructions to bidders, the proposal form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Proposal (or Alternate) is an amount stated in the Proposal to be added to or deducted from, or that does not change, the Base Proposal if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Proposal as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Proposal and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a Proposal to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Proposal, the Bidder represents that:

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Proposal complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Proposal is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to submit competitive sealed proposal, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

«Plan Room Portal Website

www.architectall.com/smith-building-renovation/

§ 3.1.2 Contractor is responsible for printing any and all sets of documents.

§ 3.1.3 Not Used

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Proposals. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Proposals on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Proposals.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

«Request for clarifications shall be submitted via email to rjones@architect-aia.com
»

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Proposals. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Proposals, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

«Addenda will be uploaded to the website plan room portal. Known plan holders will be notified via email of the Addendum. »

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than one days prior to the date for receipt of Proposals, except an Addendum withdrawing the request for Competitive Sealed Proposal or one which includes postponement of the date for receipt of Proposals.

§ 3.4.4 Prior to submitting a Proposal, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Proposal.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Proposals

§ 4.1.1 Proposals shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the Proposal form shall be legibly executed. Paper Proposal forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the Proposal form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper Proposal forms must be initialed by the signer of the Proposal.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Proposal is required, enter "No Change" or as required by the Proposal form.

§ 4.1.6 Where two or more Proposals for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Proposals stipulated by the Bidder. The Bidder shall neither make additional stipulations on the Proposal form nor qualify the Proposal in any other manner.

§ 4.1.7 Each copy of the Proposal shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Proposal, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Proposal shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Proposal by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Proposal submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Proposal.

§ 4.2 Bid Security

§ 4.2.1 Each Proposal shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

«5% of the proposal amount »

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Proposal and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of

the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Proposals may be withdrawn; or (c) all Proposals have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Proposal, a Bidder may, beginning «thirty » days after the opening of Proposals, withdraw its Proposal and request the return of its bid security.

§ 4.3 Submission of Proposals

§ 4.3.1 A Bidder shall submit its Proposal as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Proposal.)

«Sealed envelope paper copy »

§ 4.3.2 Paper copies of the Proposal, the bid security, and any other documents required to be submitted with the Proposal shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Proposals and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Proposal is submitted. If the Proposal is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED PROPOSAL ENCLOSED" on the face thereof.

§ 4.3.3 Proposals shall be submitted by the date and time and at the place indicated in the invitation to submit Competitive Sealed Proposal. Proposals submitted after the date and time for receipt of Proposals, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Proposals.

§ 4.3.5 A Proposal submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Proposal

§ 4.4.1 Prior to the date and time designated for receipt of Proposals, a Bidder may submit a new Proposal to replace a Proposal previously submitted, or withdraw its Proposal entirely, by notice to the party designated to receive the Proposals. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Proposals. The receiving party shall verify that replaced or withdrawn Proposals are removed from the other submitted Proposals and not considered. Notice of submission of a replacement Proposal or withdrawal of a Proposal shall be worded so as not to reveal the amount of the original Proposal.

§ 4.4.2 Withdrawn Proposals may be resubmitted up to the date and time designated for the receipt of Proposals in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Proposal as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Proposals, a Bidder who discovers that it made a clerical error in its Proposal shall notify the Architect of such error within two days, requesting withdrawal of its Proposal. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Proposal shall be withdrawn and not resubmitted. If a Proposal is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows: *(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)*

«Bid Security will be returned »

ARTICLE 5 CONSIDERATION OF PROPOSALS

§ 5.1 Opening of Proposals

Proposals properly identified and received within the specified time limits will be privately opened and evaluated based on the published selection criteria. Ranking of Bidders will be made public.

§ 5.2 Rejection of Proposals

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Proposals.

§ 5.3 Acceptance of Proposal (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Proposal has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Proposal received and to accept the Proposal which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Proposal and Alternates accepted.

ARTICLE 6 POST-PROPOSAL INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Proposal.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Proposals, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Proposals. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Proposal or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Proposal or Alternate Proposal to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted Proposal price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Proposal. If the furnishing of such bonds is required after receipt of Proposals and before execution of the Contract, the cost of such bonds shall be added to the Proposal in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

<< >>

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

<< >>

- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

<< >>

- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

<< >>

- .5 Drawings Refer to Exhibit A in Section 00 11 19 Request for Competitive Sealed Proposal

.6 Specifications Refer to Exhibit A in Section 00 11 19 Request for Competitive Sealed Proposal

.7 Addenda:

Number	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents listed below:

(List here any additional documents that are intended to form part of the Proposed Contract Documents.)

« »

End Section 00 21 13

DOCUMENT 002213 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

1.1 INSTRUCTIONS TO BIDDERS / OFFERORS

A. Instructions to Bidders for Project consist of the following:

1. AIA Document A701, "Instructions to Bidders," a copy of which is bound in this Project Manual.
2. The following Supplementary Instructions to Bidders that modify and add to the requirements of the Instructions to Bidders.

1.2 SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

- A. The following supplements modify AIA Document A701, "Instructions to Bidders." Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of the Instructions to Bidders shall remain in effect.

1.3 ARTICLE 1 - DEFINITIONS

- A. The term "Bid" and any and all variations or forms thereof shall have the same meaning as "Competitive Sealed Proposals" .
- B. Bidder and any and all variations or form thereof shall have the same meaning as "Offeror" or "Proposer".

1.4 ARTICLE 2 - BIDDER'S REPRESENTATIONS

A. Add Section 2.1.3.1:

1. 2.1.3.1 - The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.

B. Add Section 2.1.6:

1. 2.1.6 - The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.

1.5 ARTICLE 3 - BIDDING DOCUMENTS

A. 3.2 - Interpretation or Correction of Procurement and Contracting Documents:

1. Add Section 3.2.2.1:

- a. 3.2.2.1 - Submit Bidder's Requests for Interpretation using form bound in the Project Manual .

B. 3.4 - Addenda:

1. Delete Section 3.4.3 and replace with the following:
 - a. 3.4.3 - Addenda may be issued at any time prior to the receipt of bids.
2. Add Section 3.4.4.1:
 - a. 3.4.4.1 - Owner may elect to waive the requirement for acknowledging receipt of 3.4.4 Addenda as follows:
 - 1) 3.4.4.1.1 - Information received as part of the Bid indicates that the Bid, as submitted, reflects modifications to the Procurement and Contracting Documents included in an unacknowledged Addendum.
 - 2) 3.4.4.1.2 - Modifications to the Procurement and Contracting Documents in an unacknowledged Addendum do not, in the opinion of Owner, affect the Contract Sum or Contract Time.

1.6 ARTICLE 4 - BIDDING PROCEDURES

A. 4.1 - Preparation of Bids:

1. Add Section 4.1.8:
 - a. 4.1.8 - The Bid shall include unit prices when called for by the Procurement and Contracting Documents. Owner may elect to consider unit prices in the determination of award. Unit prices will be incorporated into the Contract.
2. Add Section 4.1.9:
 - a. 4.1.9 - Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested alternates or unit prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.
3. Add Section 4.1.10:
 - a. 4.1.10 - **The Owner is a tax exempt entity.** Bids shall include sales and use taxes as may be applicable to this project.

B. 4.4 - Modification or Withdrawal of Bids:

1. Add the following sections to 4.4.2:
 - a. 4.4.2.1 - Such modifications to or withdrawal of a bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate bylaws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to Owner at the time of seeking modifications or withdrawal of the Bid.
 - b. 4.4.2.2 - Owner will consider modifications to a bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of

the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.

C. 4.5 - Break-Out Pricing Bid Supplement:

1. Add Section 4.5:

- a. 4.5 - Provide detailed cost breakdowns no later than two business days following Architect's request.

D. 4.6 - Subcontractors, Suppliers, and Manufacturers List Bid Supplement:

1. Add Section 4.6:

- a. 4.6 - Provide list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than two business days following Architect's request. Include those subcontractors, suppliers, and manufacturers providing work totaling three percent or more of the Bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

1.7 ARTICLE 5 - CONSIDERATION OF BIDS

A. 5.2 - Rejection of Bids:

1. Add Section 5.2.1:

- a. 5.2.1 - Owner reserves the right to reject a bid based on Owner's and Architect's evaluation of qualification information submitted following opening of bids. Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of Project completion and ability to complete, record of financial management including financial resources available to complete Project and record of timely payment of obligations, record of Project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed Project staff and proposed subcontractors.

1.8 ARTICLE 6 - POSTBID INFORMATION

A. 6.3 - Submittals:

1. Add Section 6.3.1.4:

- a. 6.3.1.4 - Submit information requested in Sections 6.3.1.1, 6.3.1.2, and 6.3.1.3 no later than two business days following Architect's request.

1.9 ARTICLE 7 - PERFORMANCE BOND AND PAYMENT BOND

A. 7.1 - Bond Requirements:

1. Add Section 7.1.1.1:
 - a. 7.1.1.1 - Both a Performance Bond and a Payment Bond will be required, each in an amount equal to 100 percent of the Contract Sum.

B. 7.2 - Time of Delivery and Form of Bonds:

1. Delete the first sentence of Section 7.2.1 and insert the following:
 - a. The Bidder shall deliver the required bonds to Owner no later than 5 days after the date of Notice of Intent to Award and no later than the date of execution of the Contract, whichever occurs first. Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.
2. Delete Section 7.2.3 and insert the following:
 - a. 7.2.3 - Bonds shall be executed and be in force on the date of the execution of the Contract.

1.10 ARTICLE 9 - EXECUTION OF THE CONTRACT

A. Add Article 9:

1. 9.1.2 - Owner may deem as a default the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed.
2. 9.1.3 - Unless otherwise indicated in the Procurement and Contracting Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement or the date that the Bidder is obligated to deliver the executed Agreement and required bonds to Owner.
3. 9.1.4 - In the event of a default, Owner may declare the amount of the Bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

END OF DOCUMENT 002213

DOCUMENT 004113 - PROPOSAL FORM - STIPULATED SUM

1.1 BID INFORMATION

- A. Proposer / Offeror : _____.
- B. Project Name: Spindletop Smith Building Renovation .
- C. Project Location: 655 S. 8th Street, Beaumont, Texas 77701 .
- D. Owner: Spindletop Center .
- E. Architect: Architectural Alliance Incorporated .
- F. Architect Project Number: 21072 .
- G. RFQ # 22-0005

1.2 BASE PROPOSAL

- A. Base Proposal, Single-Prime (All Trades) Contract: The undersigned Offeror, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by Architectural Alliance Incorporated and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:
 - 1. _____ Dollars (\$_____).

1.3 BID / PROPOSAL GUARANTEE

- A. The undersigned agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:
- B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS AND SUPPLIERS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. Drywall/ Acoustical Ceilings: _____
2. Roofing Work: _____.
3. Plumbing Work: _____.
4. HVAC Work: _____.
5. Electrical Work: _____.
6. FIRE ALARM: _____
7. FIRE SPRINKLER: _____
8. Paint Work: _____
9. Glass and Glazing Work: _____
10. Doors and Hardware: _____
11. Flooring Work: _____
12. Ceramic Tiling: _____

1.5 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within _____ calendar days.

1.6 ACKNOWLEDGMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. 1, dated _____.
2. Addendum No. 2, dated _____.
3. Addendum No. 3, dated _____.
4. Addendum No. 4, dated _____.

1.7 BID SUPPLEMENTS

A. The following supplements are a part of this Bid Form and are attached hereto.

1. Bid Form Supplement - Allowances.
2. Bid Form Supplement - Bid Bond Form (AIA Document A310-2010).

1.8 SUBMISSION OF BID

A. Respectfully submitted this ____ day of _____, 2022 .

B. Submitted By: _____(Name of bidding firm or corporation).

C. Authorized Signature: _____(Handwritten signature).

- D. Signed By: _____ (Type or print name).
- E. Title: _____ (Owner/Partner/President/Vice President).
- F. Street Address: _____.
- G. City, State, Zip: _____.
- H. Phone: _____.
- I. Federal ID No.: _____ (Affix Corporate Seal Here).

END OF DOCUMENT 004113

DOCUMENT 004313 - BID SECURITY FORMS

1.1 BID FORM SUPPLEMENT

- A. A completed bid bond form is required to be attached to the Bid Form.

1.2 BID BOND FORM

- A. AIA Document A312-2010 "Bid Bond" is the recommended form for a bid bond. A bid bond acceptable to Owner, or other bid security as described in the Instructions to Bidders, is required to be attached to the Bid Form as a supplement.
- B. Copies of AIA standard forms may be obtained from The American Institute of Architects; <https://www.aiacontracts.org/>; email

END OF DOCUMENT 004313

 **AIA** Document A310™ – 2010**Bid Bond****CONTRACTOR:***(Name, legal status and address)***SURETY:***(Name, legal status and principal place of business)***OWNER:***(Name, legal status and address)***BOND AMOUNT: \$****PROJECT:***(Name, location or address, and Project number, if any)***ADDITIONS AND DELETIONS:**

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

(Contractor as Principal) *(Seal)*

(Witness)

(Title)

(Surety) *(Seal)*

(Witness)

(Title)

End Section 00 43 13

Init.

/



AIA[®]

Document A101[®] – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

Spindletop Center
655 S 8th Street
Beaumont, Texas 77701

and the Contractor:
(Name, legal status, address and other information)

[TO BE DETERMINED]

for the following Project:
(Name, location and detailed description)

SMITH BUILDING RENOVATION

The Architect:
(Name, legal status, address and other information)

Architectural Alliance, Inc
350 Pine Street, Suite 720
Beaumont, TX 77701

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®-2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®-2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Int.

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:

(Check one of the following boxes.)

- The date of this Agreement.
- A date set forth in a notice to proceed issued by the Owner.
- Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

Int.

[] Not later than () calendar days from the date of commencement of the Work.

[] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
-----------------	-----------------------------

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be (\$), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price
------	-------

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. (Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance
------	-------	---------------------------

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price
Contingency Allowance	\$100,000 (One Hundred Thousand Dollard)

§ 4.4 Unit prices, if any:

(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit (\$0.00)
------	-----------------------	-------------------------

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the seventh day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the seventh day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than thirty (30) days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™-2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201-2017;
- .3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- .4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201-2017; and
- .5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

5% Retainage

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

N/A

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

N/A

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201-2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201-2017, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201-2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201-2017, the method of binding dispute resolution shall be as follows:

(Check the appropriate box.)

- Arbitration pursuant to Section 15.4 of AIA Document A201-2017
- Litigation in a court of competent jurisdiction
- Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201-2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201-2017, then the Owner shall pay the Contractor a termination fee as follows:

(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201-2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201-2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:

(Name, address, email address, and other information)

Wayne Hill
655 S 8th Street
Beaumont, TX 77701
409-617-4746 Cell

§ 8.3 The Contractor's representative:

(Name, address, email address, and other information)

[TO BE DETERMINED]

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™-2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201-2017, may be given in accordance with AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

(If other than in accordance with AIA Document E203-2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

- .1 AIA Document A101™-2017, Standard Form of Agreement Between Owner and Contractor
- .2 AIA Document A101™-2017, Exhibit A, Insurance and Bonds
- .3 AIA Document A201™-2017, General Conditions of the Contract for Construction

(Paragraphs deleted)

- .5 Drawings

Number	Title	Date
--------	-------	------

- .6 Specifications

Section	Title	Date	Pages
---------	-------	------	-------

- .7 Addenda, if any:

Number	Date	Pages
--------	------	-------

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

(Paragraphs deleted)

- [] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
----------	-------	------	-------

- .9 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™-2017 provides that the advertisement or invitation to bid, Instructions to Bidders,

sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER (Signature)

Spindletop Center
(Printed name and title)

CONTRACTOR (Signature)

(Printed name and title)

End Section 00 52 00

init.



AIA Document A101® – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the ___ day of ___ in the year _____.
(In words, indicate day, month and year.)

for the following PROJECT:
(Name and location or address)

SMITH BUILDING RENOVATION

THE OWNER:
(Name, legal status and address)

Spindletop Center
655 S. 8th Street
Beaumont, TX 77701

THE CONTRACTOR:
(Name, legal status and address)

[TO BE DETERMINED]

TABLE OF ARTICLES

- A.1 GENERAL
- A.2 OWNER'S INSURANCE
- A.3 CONTRACTOR'S INSURANCE AND BONDS
- A.4 SPECIAL TERMS AND CONDITIONS

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201®–2017, General Conditions of the Contract for Construction. Article 11 of A201®–2017 contains additional insurance provisions.

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Table deleted)(Paragraph deleted)

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Table deleted)(Paragraph deleted)

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

(Paragraphs deleted)

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The

certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

- a. General Liability
 - 1) \$1,000,000 Each Occurrence
 - 2) \$100,000 Damage to Rented Premises (Ea Occ)
 - 3) \$5,000 Med Exp (Any one Person)
 - 4) \$1,000,000 Personal & Adv Injury
 - 5) \$2,000,000 General Aggregate (Applies to Project)
 - 6) \$2,000,000 Products – Comp/OP AGG
- b. Cyber Coverage
 - 1) \$1,000,000
- c. Pollution Coverage
 - 1) \$1,000,000
- d. Workmen's Compensation at the statutory limits.
 - 1) \$1,000,000 E.L. Each Accident
 - 2) \$1,000,000 E.L. Disease – Ea Employee
 - 3) \$1,000,000 E.L. – Policy Limit
- e. Auto Liability (Any Auto, Hired Autos, Non-Owned Autos)
 - 1) \$1,000,000 Combined Single Limit (Ea Accident)
- f. Equipment Floater
 - 1) \$250,000 Rented/Leased 1 Item
 - 2) \$250,000 Rented/Leased Total
- g. Umbrella Liability Occur
 - 1) \$2,000,000 Each Occurrence
 - 2) \$2,000,000 Aggregate
- h. Builders Risk insurance
 - 1) No less than Contract Amount

All subcontractors must have the same minimal insurance including Workmen's Compensation and General Liability:

(Paragraphs deleted)

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:

(Specify type and penal sum of bonds.)

Type	Penal Sum (\$0.00)
Payment Bond	Full Contract Amount
Performance Bond	Full Contract Amount

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

1. Contractor's insurance certificate shall verify named insured's coverage, limits, and other particulars and provide:
2. Spindletop Center named as additional insured
3. Waiver of subrogation and 30 day notice of cancellation, all in favor of Spindletop Center.

End Section 00 52 00 .01

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

CONSTRUCTION CONTRACT

Date:

Amount: \$ 0.00

Description:

(Name and location)

SMITH BUILDING RENOVATION

BOND:

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 16

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party.)

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

- .1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;
- .2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
- .3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 **Balance of the Contract Price.** The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 **Construction Contract.** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 **Contractor Default.** Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 **Owner Default.** Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 **Contract Documents.** All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corporate Seal)

Signature: _____

Name and Title: _____

Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____

Name and Title: _____

Address: _____

End Section 00 61 13 .13

Int.



AIA Document A312™ – 2010

Payment Bond

CONTRACTOR:

(Name, legal status and address)

SURETY:

(Name, legal status and principal place of business)

OWNER:

(Name, legal status and address)

CONSTRUCTION CONTRACT:

Date:

Amount: \$ 0.00

Description:

(Name and location)

SMITH BUILDING RENOVATION

BOND:

Date:

(Not earlier than Construction Contract Date)

Amount: \$

Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name and

Title:

Signature: _____

Name and

Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:

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This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

- .1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
- .2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- .1 the name of the Claimant;
- .2 the name of the person for whom the labor was done, or materials or equipment furnished;
- .3 a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- .4 a brief description of the labor, materials or equipment furnished;
- .5 the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- .6 the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- .7 the total amount of previous payments received by the Claimant; and
- .8 the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

SURETY

Company: _____ (Corporate Seal)

Signature: _____
Name and Title: _____
Address: _____

End Section 00 61 13 .16



AIA® Document A201® – 2007

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

SMITH BUILDING RENOVATION

THE OWNER:

(Name, legal status and address)

Spindletop Center
655 S 8th Street
Beaumont, TX 77701

THE ARCHITECT:

(Name, legal status and address)

Architectural Alliance, Inc.
350 Pine Street, Suite 720
Beaumont, Texas 77701

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- 5 SUBCONTRACTORS
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- 13 MISCELLANEOUS PROVISIONS
- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

ADDITIONS AND DELETIONS:

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the

portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall

continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required

submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop

Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a

party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine 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 Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed.

However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon

compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the

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Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment:

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract

Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in

whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional

insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 Insurance Limits

1. Contractors must carry following minimums:
 - a. General Liability
 - 1) \$1,000,000 Each Occurrence
 - 2) \$100,000 Damage to Rented Premises (Ea Occ)
 - 3) \$5,000 Med Exp (Any one Person)
 - 4) \$1,000,000 Personal & Adv Injury
 - 5) \$2,000,000 General Aggregate (Applies to Project)
 - 6) \$2,000,000 Products – Comp/OP AGG
 - b. Cyber Coverage
 - 1) \$1,000,000
 - c. Pollution Coverage
 - 1) \$1,000,000
 - d. Workmen's Compensation at the statutory limits.
 - 1) \$1,000,000 E.L. Each Accident
 - 2) \$1,000,000 E.L. Disease – Ea Employee
 - 3) \$1,000,000 E.L. – Policy Limit
 - e. Auto Liability (Any Auto, Hired Autos, Non-Owned Autos)
 - 1) \$1,000,000 Combined Single Limit (Ea Accident)
 - f. Equipment Floater
 - 1) \$250,000 Rented/Leased 1 Item
 - 2) \$250,000 Rented/Leased Total
 - g. Umbrella Liability Occur
 - 1) \$2,000,000 Each Occurrence
 - 2) \$2,000,000 Aggregate
 - h. Builders Risk insurance
 - 1) No less than Contract Amount
2. All subcontractors must have the same minimal insurance including Workmen's Compensation and General Liability.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework,

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testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by

fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other.

If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- 1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- 2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- 3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- 4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- 1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- 2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- 3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- 4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

(Paragraphs deleted)

§ 15.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional

person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

End Section 00 70 00

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under Owner's separate contracts.
5. Owner-furnished/Contractor-installed (OFICI) products.
6. Contractor's use of site and premises.
7. Work restrictions.
8. Specification and Drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Spindletop Silsbee .

1. Project Location: 655 S. 8th Street, Beaumont, Texas 77701.

B. Owner: Spindletop Center .

1. Owner's Representative: Wayne Hill .

C. Architect: Architectural Alliance Incorporated .

1. Architect's Representative: Ronald M. Jones, AIA 409 866-7196 [rjones@architect-
aia.com](mailto:rjones@architect-
aia.com) .

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. MEP Engineer: M&E Consulting
2. Building Envelope / Roof Consulting: Price Consulting

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Renovation of existing structure, with new addition on front. All wood framed construction. New addition has metal standing seam roof, stucco exterior walls with cultured stone wainscot, aluminum insulated windows, VRF HVAC System, new electrical service, parking lot lighting and pavement patching, and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.4 PHASED CONSTRUCTION

- A. The work will be completed in a single phase.

1.5 WORK UNDER SEPARATE CONTRACT

- A. The Owner will contract directly with a company to abate all hazardous materials from the project site.
- B. Contractor shall coordinate their demolition activities of this project with the abatement contractor

1.6 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.
- B. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.7 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

1.8 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. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Contingency allowances.

1.2 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

1.3 ACTION SUBMITTALS

- A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 LUMP-SUM ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight , and delivery to Project site.

- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.6 UNIT-COST ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight [,] and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include freight [,] and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.8 CONTINGENCY ALLOWANCES

- A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.
- B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are **NOT** included in the allowance and are part of the Contract Sum. These costs include delivery, installation, insurance, equipment rental, and similar costs.
- C. Change Orders authorizing use of funds from the contingency allowance will **NOT** include Contractor's related costs and reasonable overhead and profit.
- D. Contractor shall add overhead, profit and related costs associated with all allowances in the Base contract price. Allowance is the Net Price received from a material supplier or subcontractor.
- E. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.9 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
 - 3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Contingency Allowance: Include a contingency allowance of \$100,000.00 for use according to Owner's written instructions.

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SECTION 012100 -
ALLOWANCES

END OF SECTION 012100

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.

1.2 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.

1.3 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. Substitution Request Form: Use form acceptable to Architect.
 - 2. 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. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES .
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. 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.
 - m. 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.
3. 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.

1.4 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.

1.5 PROCEDURES

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

1.6 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.
 - 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: Architect will consider requests for substitution if received within 30 days after the Notice to Proceed . Requests received after that time may be considered or rejected at discretion of Architect.
 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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.
 - i. Requested substitution provides specified warranty.
 - j. 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.

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SECTION 012500 -
SUBSTITUTION
PROCEDURES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Arrange schedule of values consistent with format of AIA Document G703 .
 - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 - 4. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 - 5. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
 - 6. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the seventh day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month .
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- F. Transmittal: Submit one signed and notarized electronic PDF copy of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Each application shall include waivers of lien and similar attachments.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Schedule of unit prices.
 6. Submittal schedule (preliminary if not final).
 7. List of Contractor's staff assignments.
 8. List of Contractor's principal consultants.
 9. Copies of building permits.
 10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 11. Initial progress report.
 12. Report of preconstruction conference.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706.
 5. AIA Document G706A.
 6. AIA Document G707.
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Construction schedule updating reports.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:

1. PDF file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 1. Submit a working digital copy of schedule labeled to comply with requirements for submittals.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 3. Total Float Report: List of activities sorted in ascending order of total float.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.

1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from entities involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 1. Phasing: Arrange list of activities on schedule by phase.

2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Provisions for future construction.
 - c. Seasonal variations.
 - d. Environmental control.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion .
1. Temporary enclosure and space conditioning.
- E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.7 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Testing and inspection.
 - 8. Accidents.
 - 9. Meetings and significant decisions.
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.
 - 13. Orders and requests of authorities having jurisdiction.
 - 14. Change Orders received and implemented.
 - 15. Construction Change Directives received and implemented.
 - 16. Services connected and disconnected.
 - 17. Equipment or system tests and startups.
 - 18. Partial completions and occupancies.
 - 19. Substantial Completions authorized.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

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SECTION 013200 -
CONSTRUCTION PROGRESS
DOCUMENTATION

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 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."

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
8. Category and type of submittal.
9. Submittal purpose and description.

10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Paper Submittals:
1. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
 2. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
 4. Informational Submittals: Submit paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling.
- E. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email: Prepare submittals as PDF package, and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
- B. 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.
- C. 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 seven 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. Resubmittal Review: Allow seven days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- E. 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.
- F. 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.

1.6 SUBMITTAL REQUIREMENTS

- A. 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 unsuitable 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 that show 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 Shop Drawings, and before or concurrent with Samples.
- B. 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.

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. Paper 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 **30 by 42 inches**.
 - a. Two opaque (bond) copies of each submittal. Architect will return one copy.
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. 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 one 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 return submittal with options selected.
 5. 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 three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record Sample.
 - 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 three sets of paired units that show approximate limits of variations.

- D. 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:
- E. 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.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - 2. 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.
 - 3. 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.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 - 6. 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.
- H. Test and Research Reports:
 - 1. 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 substrate preparation and primers required.
 - 2. 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.
 - 3. 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.
 - 4. 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.

5. 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.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 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 insufficient 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 file paper copies 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.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals 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. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp . Include 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.
 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action [.]
 - 2. Paper Submittals: 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. Architect will discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use . Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use . Provide connections and extensions of services as required for construction operations.

1.3 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

- A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings . Keep office clean and orderly. Furnish and equip offices as follows:
1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 3. Drinking water and private toilet.
 4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction [.] and clean HVAC system as required in Section 017700 "Closeout Procedures."
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed

construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Install electric power service overhead unless otherwise indicated.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
1. Provide construction for temporary field offices, shops, and sheds located within construction area or within **30 feet** of building lines that is noncombustible according to ASTM E136. Comply with NFPA 241.
 2. Utilize designated area within existing building for temporary field offices.
 3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Storage and Staging: Use designated areas of Project site for storage and staging needs.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.
 3. Maintain and touch up signs so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- H. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."
- D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

- E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.
- J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- K. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by tenants from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
- L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
 - 1. Protect porous materials from water damage.
 - 2. Protect stored and installed material from flowing or standing water.
 - 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 - 4. Remove standing water from decks.
 - 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
 - 1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 - 2. Keep interior spaces reasonably clean and protected from water damage.
 - 3. Periodically collect and remove waste containing cellulose or other organic matter.
 - 4. Discard or replace water-damaged material.
 - 5. Do not install material that is wet.
 - 6. Discard and replace stored or installed material that begins to grow mold.
 - 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
 - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 - 2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
 - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

3.7 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
 - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
 - 2. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of cleaning agent.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest-control inspection.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect . Label with manufacturer's name and model number.
 5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
- 1.5 FINAL COMPLETION PROCEDURES
- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1.6 LIST OF INCOMPLETE ITEMS

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and , listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. MS Excel Electronic File: Architect will return annotated file.

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect .
- D. Warranties in Paper Form:
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch** paper.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
 - b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - c. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - d. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - e. Vacuum and mop concrete.
 - f. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - h. Remove labels that are not permanent.

- i. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - j. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - k. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - l. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - m. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - n. Clean strainers.
 - o. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste-disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. Submit on digital media acceptable to Architect . Enable reviewer comments on draft submittals.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
 - 2. Provide electronic copy of Final Manual in PDF format on a thumb drive.
- D. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.3 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 2. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.4 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Architect.
 7. Name and contact information for Commissioning Authority.

8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.5 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.

2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.6 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
 1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
 1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
 1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.

8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.7 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.
- C. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 3. Identification and nomenclature of parts and components.
 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 1. Test and inspection instructions.
 2. Troubleshooting guide.
 3. Precautions against improper maintenance.
 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 5. Aligning, adjusting, and checking instructions.
 6. Demonstration and training video recording, if available.

- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.
- H. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1.8 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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.
- B. Related Requirements:
 - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit one set(s) of marked-up record prints.
 - 2. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned Record Prints and one set(s) of file prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.
 - c. Final Submittal:
 - 1) Submit Record Digital Data Files and one set(s) of Record Digital Data File plots.
 - 2) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files and one paper copy of Project's Specifications, including addenda and Contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories and one paper copies 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.

1.3 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 record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. 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 for 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.
- C. Format: Identify and date each Record Drawing; include the designation "AS-BUILT DRAWING" in a prominent location.
1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file with comment function enabled.
 3. 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.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "As-Built Documents"
 - d. Name of Architect.
 - e. Name of Contractor.

1.4 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.

1.5 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.

1.6 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 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.
4. Demolition of existing items to be returned to Owner.

1.2 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.
- C. All chilled water piping, A/C Units and copper plumbing pipes to be demolished shall be returned to Owner. Owner will provide a dumpster on site for disposal of these materials.

1.3 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.4 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.5 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.
 - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
 - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
 - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
- C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction.

- Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 4. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
 5. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 6. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 CLEANING

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with **ACI 301**, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - a. For architectural concrete specified in Section 033300 "Architectural Concrete," limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:
 - a. Plywood, metal, or other approved panel materials.
 - b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - 1) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

- A. Comply with **ACI 301**.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of **ACI 117** and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes .
- C. Construct forms tight enough to prevent loss of concrete mortar.
 - 1. Minimize joints.
 - 2. Exposed Concrete: Symmetrically align joints in forms.
- D. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 - 1. Install keyways, reglets, recesses, and other accessories, for easy removal.
- E. Do not use rust-stained, steel, form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 - 1. Provide and secure units to support screed strips.
 - 2. Use strike-off templates or compacting-type screeds.
- G. At construction joints, overlap forms onto previously placed concrete not less than **12 inches**.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 - 1. Determine sizes and locations from trades providing such items.
 - 2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
 - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 4. Install dovetail anchor slots in concrete structures, as indicated on Drawings.
 - 5. Clean embedded items immediately prior to concrete placement.

3.3 SHORING AND RESHORING INSTALLATION

- A. Comply with **ACI 318** and **ACI 301** for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1. Reinforcement to Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

B. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

C. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:
 - a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, **Grade 60**, deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

2.2 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 - 1. Manufacture bar supports from steel wire or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
 - b. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
- B. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than **0.0508 inch** in diameter.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 - 1. Do not cut or puncture vapor retarder.
 - 2. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- C. Preserve clearance between bars of not less than **1 inch**, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with **ACI 318**.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or **24 inches**, whichever is greater.
 - 2. Stagger splices in accordance with **ACI 318**.
 - 3. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.

3.4 INSTALLATION TOLERANCES

- A. Comply with **ACI 117**.

3.5 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Steel-reinforcement placement.
 - 2. Steel-reinforcement welding.

SMITH BUILDING
RENOVATION

SECTION 032000 -
CONCRETE REINFORCING

END OF SECTION 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - Part I – General

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions, apply to this section.
- B. Reference structural drawings for additional notes and details reference cast-in-place concrete.

1.2 SUMMARY

- A. Section specifies cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures and finishes

1.3 RELATED SECTIONS

- A. Coordinate Work of Section with work of other sections, including Division 01 Sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work.

1.4 SUBMITTALS

- A. Product Data: Submit Manufacturer's Technical Data, installation instructions and recommendations for each product. Include data substantiating that materials comply with specified requirements.
 - 1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, joint systems, curing compounds and others as requested by Architect/Engineer.
- B. Design Mixtures: For each concrete mixture.
- C. Shop Drawings: Submit for reinforcement, prepared by Professional Engineer registered in the State of Texas for fabrication, bending and placement of concrete reinforcement. Comply with ACI SP-66(88), "ACI Detailing Manual", showing bar schedules, stirrup spacing, and diagrams of bent bars and arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- D. Laboratory test reports for concrete materials and mix design test.
- E. Materials Certificates in lieu of Material Laboratory Test Reports when permitted by Architect/Engineer. Materials Certificates shall be signed by Manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements, Provide

certification from admixtures manufacturers that chloride content complies with specification requirements,

1.5 QUALITY ASSURANCE

- A. This section outlines minimum standards and requirements. Refer to the Structural Drawings for additional requirements. In the event of conflict, information on Structural Drawings shall take precedence. Bring all conflicts and discrepancies between documents to the attention of the Architect and Engineer and do not work until such conflicts and discrepancies are clarified and corrected.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete and products and that complies with ASTM C 94/C 94M requirements for production facilities and equipments.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities"
- C. ACI Publications: Comply with the following rules unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials"
- D. Pre-Installation Conference: Conduct conference at Project site in accordance with Section 013100,"Project Management and Coordination"

PART 2 - Part II - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet

- D. Bar Supports: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic or pre-cast concrete according to CRSI's "Manual of Standard Practice"

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand and source, throughout the Project:
 - 1. Portland cement: ASTM C 150, Type I / II. Supplement with the following
 - a. Fly Ash: ASTM C 618, Class F, unless noted otherwise, no more than 15% fly ash by weight
- B. Normal-Weight Aggregates: ASTM C 33, graded, 1½" (38mm) and ¾" (19mm) nominal maximum coarse-aggregate size.
- C. Water: ATM C 94/C 94M and potable.
- D. Air-Entraining Admixture: ASTM C 260
- E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride
 - 1. Water-Reducing Admixtures: ASTM C 494/C 494M, Type A
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B
 - 3. Water-Reducing and Retarding Admixtures: ASTM C 494/C 494M, Type D
 - 4. High-Range, Water-Reducing Admixtures: ASTM C 494/C 494M, Type F
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II

2.4 VAPOR RETARDERS

- A. Plastic Vapor Retarder: ASTM E 1745, Class A, or polyethylene sheet, ASTM D 4397, not less than 15 mils (0.381mm) thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.
- B. Reference 072660 Below-Slab Vapor Barrier.

2.5 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: potable

- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering
- F. Clear, Solvent-borne, Membrane-Forming Curing Compound: ASTM C 1315, Type 1, Class A
- G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A
- H. Contractor use caution to review curing methods and chemicals with manufacturer of floor finish material to prevent compatibility issues with surface adhesion or reactions to adhesives.

2.6 RELATED MATERIALS

- A. Expansion- and Isolation-Join-Filler Strips: ASTM D 1751, asphalt-saturated cellulose fiber

2.7 CONCRETE MIXTURES

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301
- B. Proportion normal-weight concrete mixtures as follows:
 - 1. Minimum Compressive Strength: 3000 psi at 28 days for footing; 3500 psi at 28 days for all other concrete
 - 2. Maximum-Water-Cementitious Material Ratio: 0.45 slab on grade. 0.50 All other
 - 3. Slump Limit: 4" (100mm) plus or minus 1"(25mm)
 - 4. Air Content: 5.5 % plus or minus 1.5% at point of delivery for 1 ½" (38mm) nominal maximum aggregate size.
 - 5. Max 20% Fly Ash
 - 6. Air Content: No entrained air for troweled finished floors

2.8 FABRICATING REINFORCEMENTS

- A. Fabricating steel reinforcement according to CRSI's "Manual of Standard Practice"

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch mix and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 °F (30 and 32 °C), reduce mixing and delivery time from 1.5 hours to 75 minutes; when air temperature is above 90 °F (32 °C), reduce mixing and delivery time to 60 minutes.

PART 3 - Part III – EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace and maintain formwork according to ACI 301 to support vertical, lateral, static and dynamic load and construction loads that might be applied until structure can support such loads
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation and position indicated within tolerance limits of ACI 117
- C. Chamfer exterior corners and edges of permanently exposed concrete

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded

3.3 VAPOR RETARDERS

- A. Plastic Vapor Retarder: Place, protect and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6" (150mm) and seal with manufacturer's recommended tape

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete

3.5 General: Construct joints true to line with faces perpendicular to surface plane of concrete

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect
- B. Contraction joints in Slabs-on-Grade: Form weakened plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least ¼ of concrete thickness as follows:
 - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8" (3.2mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saw equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8" (3.2mm) wide joints into concrete when

cutting action will not tear, abrade or otherwise damage surface and before concrete develops random contraction cracks

- C. Isolation Joints in Slab-on-Grade: After removing formwork, install joint0filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams and other locations as indicated

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement and embedded items is complete and that required inspections have been performed
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated on architects slab plan. Deposit concrete to avoid segregation.
 - 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301
- C. Cold-Weather Placement: Comply with ACI 306.1
- D. Hot-Weather Placement: Comply with ACI 301

3.7 FINISHED FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
 - 1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish or to be covered with a coating or covering material applied directly to concrete
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
 - 1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
 - 2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part Portland cement to 1.5 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in

amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours

3. Cork-Floated Finish: Wet concrete surfaces and apply stiff grout. Mix 1 part Portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with cork float.

- D. Related Unformed Surfaces: At top of walls, horizontal offsets and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING FLOORS AND SLAB

- A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms or rakes to produce a profile amplitude of 1/4" (6mm) in 1 direction.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects and that would telegraph through applied coatings and floor coverings.
 1. Apply trowel finish to surfaces indicated, exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint or another thin-film-finish coating system.
 2. Finish and measure surface so gap at any point between concrete surface and an unlevelled, freestanding 10' (3.05m) long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8"
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with fine broom.
 1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps and elsewhere as indicated.

3.9 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 309.1 for cold weather protection and ACI 301 for hot weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder (6 mil poly) to unformed concrete surfaces if hot, dry or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1kg/sq. m 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.
- C. Cure concrete according to ACI 308.1, as follows:
 - 1. Slab - Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in the widest practicable width, with sides and ends lapped at least 12" (300mm) and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - 2. Sidewalks and site paving - 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.
 - a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with binding of floor covering used on Project.

3.10 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

3.11 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports
 - 1. Testing Services: Tests shall be performed according to ACI 301

END OF SECTION 033000

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking , cants, and nailers.
2. Wood furring and grounds.
3. Wood sleepers.
4. Plywood backing panels.

1.2 ACTION SUBMITTALS

- ##### A. Product Data: For each type of process and factory-fabricated product.

1.3 INFORMATIONAL SUBMITTALS

- ##### A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- ##### B. Evaluation Reports: For the following, from ICC-ES:
1. Wood-preservative-treated wood.
 2. Power-driven fasteners.
 3. Metal framing anchors.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- ##### A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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.
 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece .
 3. Dress lumber, S4S, unless otherwise indicated.
- ##### B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that 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 all rough carpentry unless otherwise indicated.
 - 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, furring, stripping, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than **18 inches** above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than **10.5 feet** beyond the centerline of the burners at any time during the test.
 - 1. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all rough carpentry unless otherwise indicated.
 - 1. Framing for raised platforms.
 - 2. Concealed blocking.
 - 3. Framing for non-load-bearing partitions.
 - 4. Framing for non-load-bearing exterior walls.
 - 5. Roof construction.
 - 6. Plywood backing panels.

2.4 DIMENSION LUMBER FRAMING

2.5 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.
 - 4. Cants.
 - 5. Furring.
 - 6. Grounds.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:
 - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.

2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, , fire-retardant treated, in thickness indicated or, if not indicated, not less than **3/4-inch** nominal thickness.

2.7 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
 - 1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M .

- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Comply with AWPAC M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. ICC-ES evaluation report for fastener.

3.2 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 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-clad architectural cabinets that are not concealed within other construction.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.

C. Samples: For each exposed product and for each color and texture specified.

1.3 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: 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. Environmental Limitations with Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD 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.
- B. Type of Construction: Face frame.
- C. Door and Drawer-Front Style: Flush overlay.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
- E. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS .
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade VGS.
 - 4. Edges: PVC tape, **0.018-inch** minimum thickness, matching laminate in color, pattern, and finish .
 - 5. Pattern Direction: As indicated.
- F. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
- H. 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 Noted on Drawings

2.2 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.
- B. Composite 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. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130 .
 - 2. Particleboard (Medium Density): ANSI A208.1, Grade M-2 .

3. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087100 "Door Hardware."
- B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening.
- C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal , 4 inches long, 5/16 inch in diameter .
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081 .
- F. Shelf Rests: ANSI/BHMA A156.9, B04013; metal Route bottoms of all shelves to receive pins..
- G. Drawer Slides: Blum MetaBox or approved equal
- H. Door Locks: ANSI/BHMA A156.11, E07121.
- I. Drawer Locks: ANSI/BHMA A156.11, E07041.
- J. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- K. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
 1. Color: To Be Selected .
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 1. Satin Stainless Steel: ANSI/BHMA 630.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.4 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. Adhesive for Bonding Plastic Laminate: Contact cement .
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive.

2.5 FABRICATION

- A. 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.
- B. 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.
- C. Install glass to comply with applicable requirements in Section 088000 "Glazing" and in GANA's "Glazing Manual."
 - 1. For glass in frames, secure glass with removable stops.
 - 2. For exposed glass edges, polish and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.
- B. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- 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 inches** using 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 .

3.2 FIELD QUALITY CONTROL

- A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.
 1. Inspection entity shall prepare and submit report of inspection.

END OF SECTION 064116

SECTION 072100 - 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. Acoustical Glass-fiber blanket insulation.

- B. Related Requirements:

- 1. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Glass-fiber blanket insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 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.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced : ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. CertainTeed LLC; Saint-Gobain North America.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Location:
 - a. Interior Partitions from floor to ceiling
 - b. Ceilings: Lay on ceiling extending a minimum of 24 inches out from face of wall each side of partition.

2.2 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.

PART 3 - EXECUTION

3.1 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. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. 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.

3.2 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 wood-framed construction, install blankets according to ASTM C1320 and as follows:
 - a. Unfaced blankets friction fit between studs.

3.3 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 072100

SECTION 07 22 00 ROOF BOARD INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Installation of polyisocyanurate insulation layers, tapered insulation sumps and crickets, and secondary/cover board insulation.

1.2 RELATED SECTIONS

- A. 02 40 00 - Minor Demolition and Renovation.
- B. 07 54 00 - Thermoplastic Single-ply Roof Membrane.
- C. 07 62 00 - Sheet Metal Flashing & Trim.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. FM Global Approval Guide.
- C. Underwriters Laboratories (UL): Building Materials Directory.
- D. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual.
- E. ASCE 7-10: "Minimum Design Loads for Buildings and Other Structures."
- F. Polyisocyanurate Insulation Manufacturer's Association: Technical Bulletin 109 – "Storage and Handling Recommendations for Polyisocyanurate".

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Classified by Underwriters Laboratories Inc. as Class A rated material.
 - 2. Follow local, state, and federal regulations, safety standards, and codes. When conflict exists, the more restrictive document shall govern.

B. Installation:

1. Install in accordance with manufacturer's current published application procedures, general requirements of NRCA, and as supplemented by these documents.
2. Consider roof system manufacturer's technical specifications part of this Specification and use as reference for specific application procedures.
3. Pressures are based on ASCE 7-10 and following criteria: 144 mph wind speed; Exposure B; Risk Category III; and Safety Factor of 2.0. Install roof system in manner to resist minimum wind uplift pressures as follows: 45 psf for the field of the roof; 75 psf in 8-foot wide perimeter zones; and 112.5 psf in 8-feet by 8-feet corners.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials in accordance with manufacturer's recommendations.

B. Outdoor Storage:

1. Tarp and shield insulation from moisture and exposure to sun.
2. Elevate insulation above substrate 4-inches minimum.
3. Secure insulation to resist high winds.
4. Do not use insulation which has been determined "wet" or which has been wet and has dried.
5. Distribute insulation stored on roof deck to prevent concentrated loads that would impose excessive stress or strain on deck or structural members, or impede drainage.
6. Remove manufacturer plastic shrink wrapping from materials prior to covering with protective tarps/canvas.

1.6 SUBMITTALS

- A. Product Data: Submit manufacturer's product data sheets, providing descriptive data, dimensions, LTTR values, and other pertinent criteria for each material proposed for use in construction of roof assembly.
- B. Samples: Provide physical examples of materials/components proposed for use to comprise the specified roof system.

1.7 SEQUENCING AND SCHEDULING

- A. Plan roof layout with respect to roof deck slope to prevent rainwater drainage into completed roofing.
- B. Do not install more insulation than can be made watertight in same day.

1.8 PROJECT CONDITIONS

- A. Environmental Recommendations:
1. Apply roofing and insulation in dry weather.
 2. Do not proceed with roof construction during inclement weather or when precipitation is predicted with 30 percent or more possibility.
 3. Do not apply insulation over wet or moist deck or in foggy conditions.
 4. Consider days when wind speeds are 30 mph or greater as "inclement weather" days.
- B. Maintain on site equipment and material necessary to apply emergency temporary weather protection to incomplete work in event of sudden precipitation.

PART 2 - PRODUCTS

2.1 ROOF INSULATION

- A. Flat Stock Polyisocyanurate Insulation: Rigid, closed cell polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to non-asphaltic coated fiberglass facers meeting ASTM C 1289, Type II, Class 2, Grade 2; maximum board size is 4-feet by 4-feet; two layers 2.5-inch and 2.0-inch thickness such as "ACFoam-III" by Atlas Roofing Corp, "EnergyGuard Ultra" by GAF, "SecureShield" by Carlisle, "Resista" by Firestone, "ENRGY3 CGF" by Johns Manville, or approved equal.
- B. Tapered Polyisocyanurate Insulation: Rigid, closed cell tapered polyisocyanurate rigid board insulation utilizing non-chlorine/non-ozone depleting blowing agent, bonded to non-asphaltic coated fiberglass facers meeting ASTM C 1289, Type II, Class 2, Grade 2; maximum board size is 4-feet by 4-feet; such as "Tapered ACFoam-III" by Atlas Roofing Corp, "Tapered EnergyGuard Ultra" by GAF, "Tapered SecureShield" by Carlisle, "Tapered Resista" by Firestone, "Tapered ENRGY3 CGF" by Johns Manville, or approved equal.
- C. Cover Board:
1. Moisture-resistant, 1/2-inch thick gypsum core roof board such as "SecuRock" by US Gypsum, "DensDeck Prime" by Georgia-Pacific, or approved equal.
 2. High-Density Polyisocyanurate: High-density polyisocyanurate bonded to fiberglass reinforced facer meeting ASTM C 1289, Type II, Class 4, Grade 1, 1/2-inch thickness, 4-foot by 4-foot size boards such as "ProtectorR HS" by Johns Manville, "EnergyGuard HD Polyiso Cover Board" by GAF, or "SecurShield HD" by Carlisle.
- D. Tapered Edge Strip: Tapered perlite complying with ASTM C-728, to be used for tapered edge strips, size 1/2-inch (13mm) to 1-1/2-inch (37.5mm) thick by 6-inches (150mm) to 24-inches (600mm) wide such as "Tapered Fesco Edge Strip" by Johns Manville.

2.2 RELATED MATERIALS

- A. Heat Resistant Insulation: Molded hydrous calcium silicate-based or mineral wool-based heat resistant rigid pipe insulation, 2-inches in thickness and sized for installation around circular/tubular element such as “Sproule WR-1200” by Johns Manville or “Thermafiber Pro Section WR” by Owens Corning
- B. Compressible Fill Insulation: Foil or paper faced compressible fiberglass batten roll insulation of proper size and thickness to insert at openings at penetrations, perimeters, and curbs such as manufactured by Owens Corning.
- C. Low-Rise Foam Insulation Adhesive:
 - 1. Single-component Moisture-cured Adhesive: ASTM D-2126, dispensed from portable pressurized containers, such as “Insta-Stik Professional Roofing Adhesive” by Dow Chemical Co., “ISO Stick” by Firestone, or approved equal
 - 2. Dual-component Reaction-cure Adhesive: Two-part spray-applied low-rise urethane foam adhesive such as "OlyBond 500" by OMG, “JM Two-Part Urethane Adhesive” by Johns Manville, “Twin Jet” by Firestone, “FAST Adhesive” by Carlisle, or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Roof system manufacturer's representative shall inspect roof deck and associated substrates and provide written acceptance of conditions.
- B. Manufacturer's approved roofing contractor shall inspect and approve deck and substrates.
- C. Roofing contractor shall examine roof deck and related substrates and verify that there are no conditions that would prevent roof system manufacturer's approved application of roof system. These conditions include, but are not limited to, the following:
 - 1. Inadequate support or anchorage of decking or substrates to structure.
 - 2. Accumulations of moisture.
 - 3. Tears, holes, cracks, or punctures.
 - 4. Ridges, uneven conditions, or gaps.
 - 5. Rust or other forms of deterioration.
 - 6. Presence of foreign materials.
- D. Start of work constitutes acceptance of substrate and site conditions.

3.2 PROTECTION

- A. Provide special protection from traffic on yet to be removed roofing and newly installed roof materials.

3.3 PREPARATION

- A. Do not install insulation until defects in roof deck and substrates are corrected in order to meet roof system manufacturer's requirements and to ensure that deck conditions will not restrict roof drainage.
- B. Broom sweep and clean areas to receive new insulation.
- C. Perform bonded adhesion tests in general accordance with ANSI/SPRI IA-1-2015 with specified insulation and adhesive on the existing concrete deck. Provide results of the tests to Consultant/Engineer and manufacturer for determination of method of attachment.

3.4 INSTALLATION

A. Insulation - General:

- 1. Install specified insulation continuous across the roof deck in general accordance with manufacturer's guidelines.
- 2. Stagger end joints of insulation boards 1/2 of overall length of board. Stagger joints of subsequent insulation layers from underlying insulation layer.
- 3. Butt joints tightly allowing no more than 1/4-inch (6mm) wide gaps between units. Fill joints between adjacent boards with like insulation or foam adhesive.
- 4. Do not use warped, bent, or otherwise damaged insulation boards.
- 5. Field cut and fit insulation at penetrations, curbs, and walls.
- 6. After installation of initial layer of insulation, install subsequent layers of insulation directly over preceding layer.
- 7. Stagger all joints (side and end) between layers of insulation.
- 8. Field cut tapered insulation boards to create crickets at upslope sides of curbs and create sumps around roof drains, scuppers, and along edges with gutters to direct water to drainage medium.
- 9. Install tapered edge strips at changes in elevations, edges of crickets, and other locations to create monolithic and uniform substrate for installation of roof membrane.

B. Adhered Insulation:

- 1. Install and adhere insulation layers, tapered insulation, and cover board over substrate and to receive roof membrane in accordance with manufacturer's guidelines and as specified herein.
- 2. Ribbon Application of Low-rise Foam Adhesive: Dispense 3/4-inch to 1-inch (19mm to 25mm) diameter continuous ribbon of adhesive placed 3-inches (75mm) inside each edge/side of the insulation board in picture-frame fashion. Dispense remaining ribbons of adhesive between "picture-frame" placed adhesive ribbons spaced: spaced 12-inches (300mm) on-center in the field of the roof, spaced 6-inches (150mm) on-center within an 8-foot wide area along the roof perimeters, and spaced 3-inches on-center within an 8-foot by 8-foot area at corners.
- 3. On additional insulation layers, dispense ribbons of adhesive in direction perpendicular to the direction of the beads that were dispensed on the underlying layer.

4. Firmly set insulation boards in the ribbons of foam adhesive following application of the adhesive when adhesive has risen to proper height and walk-in the insulation to spread the adhesive ribbons, ensuring maximum contact. Do not push or slide insulation into position. Set weighted objects on sides, ends, and corners of boards until insulation is firmly attached (approximately 20 to 45 minutes).
5. Fill voids or open joints in top layer of insulation and cover board with spray-foam adhesive to provide monolithic surface to receive new membrane.
6. Adhere partial boards and tapered edge strips with adhesive ribbon positioned in picture-frame fashion along perimeter of board and remaining adhesive ribbons spaced in accordance with location on roof (field, perimeter, or corner).

B. Heat Exhaust Vents:

1. Install heat resistant insulation around existing heat exhaust flue, vent pipes, or other penetrations that experience elevated operation temperature.
2. Install new sheet metal base around insulation and strip flange into new roof.

C. Insulation Filler: Install compressible fiberglass insulation at openings in deck at penetrations, perimeters, expansion joints, and/or curbs.

3.5 CLEANING

- A. Remove debris and material wrappers from roof to dumpster daily. Leave insulation clean, dry, and ready to receive new roofing.

3.6 ADJUSTING

- A. Remove damaged insulation and install acceptable new units before installation of roof system.

3.7 PROTECTION

- A. Provide special protection from traffic on completed work.

END OF SECTION 07 22 00

SECTION 07 54 00 THERMOPLASTIC SINGLE-PLY ROOF MEMBRANE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Installation of fully-adhered reinforced thermoplastic single-ply membrane roofing system and related flashings and accessories.

1.2 RELATED SECTIONS

- A. 02 40 00 - Minor Demolition and Renovation Work
- B. 07 22 00 - Roof Board Insulation.
- C. 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. National Roofing Contractors Association (NRCA): The NRCA Roofing and Waterproofing Manual, latest Edition.
- C. ASCE-7: "Minimum Design Loads for Buildings and Other Structures".
- D. ANSI/SPRI WD-1 "Wind Design Standard Practice" for Roofing Assemblies".
- E. Single Ply Roofing Industry (SPRI); "Application Guidelines for Thermoplastic Roofing Systems," and "Guidelines for the Fabrication of Heat Welded Seams."
- F. FM Global Property Loss Prevention Data Sheets
 - 1. DS 1-28 "Wind Design".
 - 2. DS 1-29 "Roof Deck Securement and Above-deck Roof Components".
 - 3. DS 1-49 "Perimeter Flashing".

1.4 QUALITY ASSURANCE

- A. Applicator:
 - 1. Approved by manufacturer of accepted roofing system.
 - 2. A single applicator with a minimum of five years previous successful experience in installations of similar systems.

3. Minimum five years experience in single-ply roofing with two years experience seaming system same as one currently being proposed.
 4. Be present at job site at all times when work is being performed. Supervise workers as required to ascertain workmanship, progress, and adherence to details.
 5. Report to Owner's Representative.
 6. Be responsible for schedule and coordination.
 7. Have authority to make binding commitments upon Contractor in the field.
- B. Regulatory Requirements: Classified by Underwriters' Laboratories, Inc. as a UL 790 Class A roof covering.
- C. Notify Owner's Representative a minimum of forty-eight hours in advance of start of field work.
- D. Schedule manufacturer's technical representative to be on site during initial membrane installation and periodically during project duration. Contractor shall provide a written report from Manufacturer's representative site visits to Owner's Representative after each inspection outlining observations and any corrective procedures.
- E. Install roof system in manner to resist minimum wind uplift pressures of: Pressures are based on ASCE 7-10 and following criteria: 144 mph wind speed; Exposure B; Risk Category III; and Safety Factor of 2.0. Install roof system in manner to resist minimum wind uplift pressures as follows: 45 psf for the field of the roof; 75 psf in 8-foot wide perimeter zones; and 112.5 psf in 8-foot by 8-foot corners.
- F. Refer to applicable building codes for roofing system installation requirements and limitations. When a conflict exists, the more restrictive document will govern.
- G. Provide tested and approved system to meet or exceed the specified wind uplift pressures.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.
- B. Store materials in accordance with manufacturer's recommendations. Store rolled goods on clean raised platforms. Store other materials in dry area, protected from water and direct sunlight, and maintain at a temperature of 50 to 90 degrees Fahrenheit (10 to 32 degrees Celsius).
- C. Deliver materials in sufficient quantities to allow continuity of work without delay.
- D. Store materials in weather protected environment, clear of ground, and free from moisture. Protect materials against damage. Keep all materials used in construction of the roofing free from moisture prior to and during application. Do not store in plastic bags or other protective coating which may create condensation within bags.

- E. Store roof insulation and membrane on pallets or dunnage elevated at least 4-inches (100mm) above the ground, surface, roof, or deck and protect as necessary to keep dry.
- F. Handle materials so as to prevent damage to roofing system components and completed roof system.
- G. Proper storage of materials is the sole responsibility of Contractor. Protect materials susceptible to moisture including, but not limited to, all roll goods, insulation, wood, and plywood in dry, above ground, watertight storage. Keep labels intact and legible, clearly showing the product, manufacturer, and other pertinent information.
- H. Any materials becoming wet or damaged will be rejected and shall be removed from job site immediately. Any materials found to be improperly stored at jobsite shall be considered wet at the discretion of Owner's Representative and removed from jobsite.
- I. Store products in temperature-controlled environment to prevent detrimental affects from low or elevated temperatures.

1.6 PROJECT CONDITIONS

- A. Substrate Conditions: Examine substrates to determine physical conditions that may affect installation of new roofing.
- B. Environmental Requirements:
 - 1. Apply roofing in dry weather.
 - 2. Do not install roofing and flashing in inclement weather or when rain is predicted (30 percent or more possibility).
 - 3. When ambient temperature is below 60 degrees Fahrenheit (16 degrees Celsius), expose only enough sensitive cements, sealants, and adhesives as required within a four hour period.
 - 4. Do not expose membrane and accessories to a constant temperature in excess of 180 degrees Fahrenheit (82 degrees Celsius).
- C. Protection:
 - 1. Provide special protection and avoid traffic on completed areas of membrane installation.
 - 2. Restore to original condition or replace work or materials damaged during handling of roof materials.
 - 3. Take precautions as required to protect adjacent work and structures.
- D. Emergency Equipment: Maintain on site equipment necessary to apply emergency temporary protection to existing roof, newly installed roof, and building in event of sudden storms or inclement weather.

1.7 SEQUENCING/SCHEDULING

- A. Do not remove existing roofing in one day than can be replaced and made watertight in same day.
- B. Install new roof system immediately after completion of insulation and cover board installation.
- C. Schedule work as required to prevent traffic and material handling over completed work.

1.8 WARRANTY

- A. Contractor: Provide Owner a written warranty for a period of two years after Owner's final acceptance covering all repairs required to correct all defects due to faulty materials or workmanship and to otherwise maintain the roof in a watertight condition and to correct all other defects without regard to watertightness. Make repairs promptly on notification and at no expense to Owner.
- B. Roof System Manufacturer: Manufacturer of the single-ply membrane roof system shall furnish a full system (including insulation layers, fasteners/adhesives, membrane, and flashings), no dollar limitation, written guarantee to cover labor and materials for faulty installation or defective materials thereof for a period of twenty years from date of Owner's final acceptance

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable PVC/KEE Manufacturers:
 - 1. Johns Manville.
 - 2. GAF Materials Corp.
 - 3. Carlisle, Inc.
 - 4. Seaman Corp.
 - 5. Siplast, Inc.
- B. Products furnished for roofing system shall be products of a single manufacturer.

2.2 SINGLE-PLY ROOFING MEMBRANE

- A. PVC/KEE Single Ply Membrane: Polyester-reinforced elastomeric sheet compounded with PVC/KEE polymer, complying with ASTM D 4454 for PVC/KEE membranes and ASTM D 6754 for KEE membrane, minimum 0.060-inch (60-mil) thickness, white in color, with a minimum solar reflectance of 0.70 and thermal emittance of 0.75 such as "Sure-Flex PVC KEE" by Carlisle, "JM PVC KEE" by Johns Manville, "EverGuard PVC XK60" by GAF, "Fibertite XT" by Seaman Corp., "ParaSolo" by Siplast, or approved equal.

2.3 RELATED MATERIAL

- A. Flashing: Minimum 60-mil, reinforced or unreinforced, flashing membrane as required and furnished by membrane manufacturer, white in color.
- B. Bonding Adhesive (Option): Low-solvent or water-based VOC compliant bonding adhesive furnished by membrane manufacturer for adhering flashing membrane or roof membrane to substrates such as “Sure-Weld/Sure-Flex Low VOC Bonding Adhesive” by Carlisle. Bonding Adhesive; "JM TPO/PVC Membrane Adhesive (Low VOC)" by Johns Manville, "EverGuard H20 Bonding Adhesive" by GAF, or other manufacturer’s approved adhesive for membrane and substrate.
- C. Bonding Adhesive (Option): Solvent-based low-VOC compliant spray-applied contact bonding adhesive furnished by membrane manufacturer for adhering flashing membrane or roof membrane to substrates such as “CAV-GRIP III Adhesive/Primer” by Carlisle; “Jet Bond Sprayable Bonding Adhesive” by Johns Manville, or other similar manufacture’s approved adhesive for membrane and substrate.
- D. Sealants: Membrane manufacturer's approved sealant to seal penetrations through the membrane system or miscellaneous caulking applications that come in contact with roof system components.
- E. Lap/Seam Sealant: Liquid formulation sealant. As furnished by membrane manufacturer for sealing cut edges of reinforced membrane and flashing sheets.
- F. Water Cut-off Mastic: As furnished by membrane manufacturer for this system.
- G. Inside Corners and Outside Corners and Molded Pipe Flashings: White molded pipe flashings as furnished by membrane manufacturer for this system.
- H. Walkway Pads: Thermoplastic polyester-reinforced flexible walkpads with diamond-tread textured surface on other approved non-slip surface, as approved by membrane manufacturer.
- I. Sponge Tubing: 2-inch diameter compressible foam rubber tubing for use at expansion joints.
- J. Protection Sheet: Cut sections of membrane with rounded corners, extending a minimum of 2-inches beyond edges of overlying item.
- K. Other miscellaneous materials shall be of the best grade available and approved in writing by roof system manufacturer for the specific application.

PART 3 - EXECUTION

3.0 GENERAL

- A. Perform entire work of this Section in accordance with the best standards of practice relating to trades involved.
- B. Follow local, state, and federal regulations, safety standards, and codes. When conflict exists, the more restrictive document shall govern.
- C. Consider roof system manufacturer's current technical specifications a part of this Specification and use as a reference for specific application procedures and recommendations.

3.1 EXAMINATION OF SURFACES

- A. Verify that all components of the existing roofing system have been removed and other preparatory work has been completed.
- B. Examine roof areas for conditions that would prevent proper application of new roofing.
- C. Verify that all demolition, renovation, and substrate replacement work has been completed and cured.
- D. Verify that new wood nailers are properly installed to receive new roofing system.
- E. Examine substrate, roof deck, and related surfaces, and verify that there are no conditions such as inadequate anchorage, foreign materials, moisture, ridges, or other conditions which would prevent the satisfactory installation of the roofing system.
- F. Correct or complete any conditions requiring correction or completion prior to installation of roofing system. Notify Owner's Representative in writing of unacceptable conditions.
- G. Verify location of all interior ducts, electrical lines, piping, conduit, and/or similar obstructions. Perform all work in such a manner as to avoid contact with the above-mentioned items.
- H. Start of work under this Section constitutes acceptance of substrate and site conditions.
- I. Verify:
 - 1. Deck and substrates are clean, smooth, and free from depressions, waves, projections, defects, and damage.
 - 2. Surfaces in contact with any single-ply material are free from bitumen, grease, oil, or other foreign material.
 - 3. Surfaces in contact with roofing membrane are free from sharp edges, fins, or projections.
 - 4. All materials are completely dry and free from ice and snow, including substrate, deck, insulation, and roofing membrane as applicable. Confirm dryness by moisture meter and demonstrate to Owner's Representative.

5. All roof equipment, openings, curbs, pipes, sleeves, ducts, vents, and blocking members are solidly and properly set.
6. All mechanical/electrical work to be covered has been installed, tested, and approved.
7. Work has been completed where possible for all other trades that require work or traffic on the roofing area.

3.2 PREPARATION

- A. Verify that debris has been completely removed.
- B. Broom clean roof insulation immediately prior to roof membrane application. Debris under roof membrane is unacceptable.

3.3 APPLICATION

A. Roofing Membrane - General:

1. Install roof membrane in accordance with roofing manufacturer's specification and installation instructions and as supplemented herein. Cut sheets to maximum size possible in order to minimize seams.
2. Position membrane over substrate without stretching membrane. Allow membrane to relax for one-half hour before bonding, fastening, welding, and flashing.
3. Begin installation of new roofing system at the lowest point of the project area and work to the highest point to prevent backwater laps. This will include completion of all flashings, terminations, and seals on a daily basis.
4. Execute work so membrane can be temporarily sealed on a down slope surface at the end of each day with nite-seal in accordance with the detail drawings.
5. Remove and discard portions of the roof membrane that have permanent creases and/or wrinkles prior to installation.

B. Adhered System:

1. Position membrane over substrate and fold membrane back so half the underside is exposed.
2. Apply bonding adhesive to exposed underside of membrane and the corresponding substrate area with a plastic core medium nap paint roller at a coverage rate of approximately 60 square feet per gallon or as recommended by membrane manufacturer for respective adhesive per finished surface (includes coverage on both membrane and substrate).
3. Allow adhesive to dry until tacky and roll the coated membrane into the coated substrate while avoiding wrinkles.
4. Brush down the installed membrane immediately with a soft bristle push broom.
5. Fold back the unbonded half of the sheet and repeat the bonding procedures.
6. Install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2-inches (50mm) to provide for a minimum of 1-1/2-inch (38mm) hot air weld achieved with robotic welder.

7. Roll adhered membrane with cushioned weighted roller to eliminate air pockets, wrinkles, voids, and other potential non-adhered portions of the membrane.
8. Secure membrane at perimeter of each roof level, roof section, curb, interior wall, etc., and at all other penetrations in accordance with manufacturer's published details.

C. Membrane Splicing:

1. Membrane lap splices for membrane overlaps along the length of the membrane shall be as necessary to achieve proper weld; 1-1/2-inches wide for robotic welder and 2-inches wide for hand-held welder. Splices at end roll overlaps (width of the membrane) shall be 6-inches (150mm) wide, minimum.
2. Allow top sheet to fall freely into place over bottom ply without wrinkling or stretching.
3. Surfaces to be welded must be cleaned, primed and dirt-free. Remove excessive dirt by washing with a detergent. Rinse thoroughly, allow to dry, and then wipe surface with manufacturer's solvent/cleaner.
4. Use automatic hot-air welding equipment approved by roof system manufacturer for all field seams. Perform small work and repairs using hand-held welders.
5. Probe all laps each day to verify that welder set-up is effective. Allow membrane to cool prior to probing seams. In addition, perform random pull tests of welded lap seam samples (including tests at start of each day and start-up of equipment) to verify peel strength. Apply lap seam sealant along cut edges of the membrane and reinforced flashing material.
6. Apply a pre-formed membrane patch over T-joints of overlapping flashing and membrane lap seams.

D. Flashing:

1. General:
 - a. Install flashing at roof penetrations, interruptions, and any roof intersection including roof edges with vertical or sloped surfaces in accordance with manufacturer's recommended procedures and the detail drawings.
 - b. Raise/modify curbs, projections, and risewall conditions as required to accommodate new roofing.
 - c. Apply manufacturer's bonding adhesive to both underside of flashing and surface to which it is to be bonded, at a rate of approximately one gallon (3.8 liter) per 50 square feet (4.6m²) of surface coverage or as recommended by manufacturer for respective adhesive.
 - d. Do not apply bonding adhesive to that portion of flashing that overlaps onto itself. Use hot-air welding throughout the system where membrane overlaps itself.
 - e. Allow bonding adhesive to dry to finger touch until it does not string or stick to a dry finger. Roll the flashing into adhesive. Take care to assure that flashing does not bridge where there is any change of direction.
 - f. Mechanically fasten top edges of flashing through appropriate termination bar with approved fasteners apply water-block behind top edge of flashing prior to installation of termination bar.
 - g. Install flashings for vents, pipe, conduits, and other round projections in accordance with manufacturer's recommendations and the detail drawings.
 - h. Install preformed flashing membrane as required to form a continuous membrane seal in each corner or change in plane.

- i. Install pre-molded outside and inside corner pieces at appropriate locations along walls and around curbs.
 - j. Apply cut-edge sealant along seams of strip-ins, T-joint patches, miscellaneous membrane patches, and other flashings terminated on the roof membrane.
2. Penetrations:
 - a. Flash penetrations with pre-formed, field-formed flashings, or polymer-coated metal as indicated on drawings.
 - b. Apply sealant or water cut-off mastic at top of flashing between flashing and penetration.
 - c. After flashing is installed, secure with steel draw band and seal top edge with sealant.
 - d. Install grout and pourable sealer in sheet metal pan. Install sheet metal bonnet or hood/cover over sheet metal flashing pan at penetrations.
 3. Curbs:
 - a. Extend flashing membrane to designated height on curbs.
 - b. At curbs with removable cover/hood, wrap flashing over top of curb and secure with angle termination bar.
 - c. At curbs with non-removable cover/hood, extend flashing to maximum height and secure with termination bar with fasteners at 6-inches on-center. Apply water block behind top edge of flashing and apply sealant along top edge of termination bar.
 - d. Extend flashings at corners of curbs to form rounded outer corners at horizontal tie-ins. Apply pre-molded outside corner pieces at corners.
 4. Polymer-coated Metal:
 - a. Install polymer-coated metal flashings at curbs, penetrations, and perimeters as designated.
 - b. Hot-air weld flashing membrane to coated metal and field membrane to provide monolithic seal, extending a minimum of 4-inches (100mm) beyond end of flange.
 - c. Apply sealants at fastening points under flanges.
- E. Walk Pads/Protection Pads:
1. Install walk pads at roof access points and around rooftop equipment in accordance with manufacturer's installation guidelines.
 2. Install protection pads under equipment and piping supports and other items installed on top of the roof surface.
 3. Do not install walkpads over seams of field membrane for flashings. Fully weld perimeters of walk pads to field membrane. Remove air or water entrapped under walk pads and wrinkles protruding upward from surface of walk pad.
- F. Daily Seal:
1. Ensure that water does not flow beneath any completed sections of membrane system. This will include completion of all flashings, terminations, and daily seals.
 2. Seal new membrane at the deck level and on top of existing roof surface.
 3. Temporarily seal any loose membrane edge with manufacturer's water cut-off sealant. Exercise caution to ensure that membrane is not temporarily sealed in such a manner as to promote water migration below the membrane or impede drainage.
 4. Install daily night seals by extending the roof membrane beyond the insulation and sealing to existing roof surface.

5. When work is resumed, remove and dispose of membrane where sealants or other materials were previously applied before resuming installation.

3.4 CLEANING

- A. Upon completion of installation of roof system, flashings, and sheet metal, clean surfaces of roof membrane and membrane flashings by power washing methods. Remove debris, dirt, adhesives, sealants, surface contaminants, or materials that cause surface discoloration from surfaces.
- B. Remove all work related dirt, debris, drippage, spills, etc. from finishes of roof surface, building, or building grounds.

END OF SECTION 07 54 00

SECTION 072600 - VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Products supplied under this section:

1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:

1. Section 033000 Cast-in-Place Concrete

1.2 REFERENCES

A. ASTM International:

1. ASTM E1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
2. ASTM E1643-18a Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
2. ACI 302.1R-15 Guide to Concrete Floor and Slab Construction.

1.3 SUBMITTALS

A. Quality control/assurance:

1. Summary of test results per paragraph 9.3 of ASTM E1745.
2. Manufacturer's samples and literature.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor barrier shall have all of the following qualities:

1. Maintain permeance of less than 0.01 Perms grains/(ft² · hr · inHg) as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Other performance criteria:
 - a. Strength: ASTM E1745 Class A.
 - b. Thickness: 20 mils minimum
3. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor barrier products:

1. Basis of Design: Stego Wrap 20-Mil Vapor Barrier by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com

2.2 ACCESSORIES

A. Seams:

1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Sealing Penetrations of Vapor barrier:

1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/edge seal: Stego Crete Claw by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

1. Stego Crete Claw by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com
2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
3. StegoTack Tape (double-sided sealant tape) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

D. Penetration Prevention:

1. Beast Foot by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.
2. Beast Form Stake by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com

E. Vapor Barrier-Safe Screed System

1. Beast Screed by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.
2. Beast Hook by Stego Industries, LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

3.2 INSTALLATION

- A. Driving stakes through the vapor barrier will not be allowed. Utilize "Penetration Prevention" products as specified.
- B. Install vapor barrier in accordance ASTM E1643.
 - 1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.
 - 2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
 - a. Seal vapor barrier to the entire slab perimeter using Stego Crete Claw, per manufacturer's instruction OR
 - b. Seal vapor barrier to the entire perimeter wall or footing/grade beam with double sided StegoTack Tape, or both Stego Term Bar and StegoTack Tape, per manufacturer's instructions. Ensure the concrete is clean and dry prior to adhering tape.
 - 3. Overlap joints 6 inches and seal with manufacturer's seam tape.
 - 4. Apply seam tape/Crete Claw to a clean and dry vapor barrier.
 - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 6. For interior forming applications, avoid the use of non-permanent stakes driven through vapor barrier. Use Beast Form Stake and Beast Foot as a vapor barrier-safe forming system. Ensure Beast Foot's peel-and-stick adhesive base is fully adhered to the vapor barrier.
 - 7. If non-permanent stakes must be driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
 - 8. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.
 - 9. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.
 - 10. For vapor barrier-safe concrete screeding applications, install Beast Screed (vapor barrier-safe screed system) per manufacturer's instructions prior to placing concrete.

END OF SECTION 072600

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Shop or field-formed sheet metal work for moisture protection.
- B. Types of work specified in this Section include:
 - 1. Roof penetrations and bonnets.
 - 2. Counter flashings.
 - 3. Coping.
 - 4. Roof drains.
 - 5. Plumbing vent pipes.
 - 6. Curb cap flashings.
 - 7. Heat exhaust vents.
 - 8. Pipe box.
 - 9. Gutters and downspouts.
 - 10. Miscellaneous sheet metal accessories.

1.2 RELATED SECTIONS

- A. 02 40 00 - Minor Demolition and Renovation Work.
- B. 07 54 00 - Thermoplastic Single-Ply Roof Membrane

1.3 REFERENCES

- A. American Society for Testing and Materials (ASTM).
- B. Federal Specifications (FS).
- C. National Roofing Contractor's Association (NRCA): NRCA Roofing and Waterproofing Manual, latest edition.
- D. Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA): Architectural Sheet Metal Manual, latest edition.
- E. ANSI/SPRI ES-1: "Wind Design Standard for Edge Systems Used With Low Slope Roofing Systems."

1.4 WARRANTY

- A. Contractor's Warranty: Provide Owner a written warranty which shall warrant sheet metal work to be free of leaks and defects in materials and workmanship for two years after date of final acceptance by Owner.
- B. For pre-finished metal, provide manufacturer's twenty-year guarantee covering deterioration or failure of the fluoropolymer finish.

1.5 PERFORMANCE REQUIREMENTS

- A. Roof edge sheet metal flashing shall be certified by the manufacturer or shop-fabricator to comply with ANSI/SPRI Standard ES-1 for 150 mph wind speed and horizontal design pressure and vertical design pressure applicable for the eave height of the subject building. ANSI/SPRI ES-1 Test Method RE-3 Test for Copings: The coping shall be tested for 150 mph wind speed and horizontal design pressure and vertical design pressure applicable for the eave height of the subject building
- B. The sheet metal coping product shall be UL Classified by Underwriters Laboratories, Inc. or other third-party verification of compliance with the ANSI/SPRI ES-1 Wind Design Standard.
- C. Provide base sheet metal that is manufactured in the United States and incorporates some percentage of recycled content. Provide documentation from manufacturer/supplier supporting this information.

1.6 MOCK-UPS

- A. Contractor to prepare mock-ups utilizing materials proposed for the finished product and to simulate the desired appearance of the finished product. Mock-ups shall be of appropriate size to depict finishes and connections
- B. Schedule of mock-ups shall include the following: Typical wall counter flashing condition(s); Typical metal edge/fascia condition(s); size of mock-ups shall be 3 feet minimum.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Pre-finished Sheet Metal Manufacturers:
 - 1. Berridge Manufacturing Company.
 - 2. Peterson Aluminum Corporation (PAC CLAD).
 - 3. McElroy Metals, Inc.

4. Metal Building Components, Inc. (MBCI).
5. Firestone Metal Co (Una-Clad).
6. Or approved equal.

2.2 SHEET METAL MATERIAL

- A. Pre-finished Metal: "Kynar 500" or "Hylar 5000" fluoropolymer pre-finished G90 galvanized/galvalume sheet metal, minimum 24 gauge. "Kynar 500" or "Hylar 5000" finish shall consist of a two coat Polyvinyladine flouride, minimum 70 percent by weight in coatings, dry film thickness 1 mil, factory applied by metal manufacturer or supplier. Color selected by Owner from manufacturer's standard color chart.
- B. Zinc-coated (Galvanized) Sheet Metal: Commercial quality with 0.20 percent copper, in accordance with ASTM A 526 except ASTM A 527 for lock forming; coating designation G90 hot-dip galvanized, 24 gauge minimum.
- C. Stainless Steel Sheet Metal: ASTM A240, Type 304, ASTM A480, No. 2B/2D Mill Finish, gauge as scheduled.

2.3 FASTENERS

- A. Fasteners shall be same metal as flashing and sheet metal being joined.
- B. Exposed fasteners shall be self-sealing or gasketed for watertight installation.
- C. Heads of fasteners, including but not limited to, rivets, screws, and bolts, that are exposed or visible shall have same manufactured finishes as item being secured; color to match when applicable.
- D. Mechanical Fasteners:
 1. Refer to Section 02 40 00 – Minor Demolition and Renovation Work.
 2. Washers: Steel washers with bonded rubber sealing gasket.
 3. Screws: Self-tapping sheet metal type compatible with material fastened.
 4. Rivets: Stainless steel material for the head and stem, closed end, color to match sheet metal items being adjoined.

2.4 RELATED MATERIALS

- A. Solder:
 1. ASTM B 32, alloy grade 58, 50 percent tin, 50 percent lead.
 2. For Use with Stainless Steel: 60-40 tin/lead solder, ASTM B 32.

- B. Flux:
1. Phosphoric acid type, manufacturer's standard.
 2. For Use with Steel or Copper: Rosin flux.
 3. For Use with Stainless Steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.
- C. Adhesives: Type recommended by flashing sheet manufacturer for waterproof and weather resistant seaming and adhesive application of flashing sheet.
- D. Metal Accessories: Sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of work, matching or compatible with material being installed, noncorrosive, size and gauge required for performance.
- E. Sealant:
1. Type A: One component polyurethane sealant such as "Sikaflex 1a" by Sika Corp. or "Sonolastic NP1" by BASF, color to match finish of metal.
 2. Type B: Low modulus silicone sealant for sealing metal-to-metal surface (i.e. metal edge, cover plates) such as "Sikasil WS-290" or "Sikasil WS-295" by Sika Corp., "795 Silicone Building Sealant" or "790 Silicone Building Sealant" by Dow Corning, or "GE Silpruf 2000" by Momentive Performance Technologies; color to match finish of metal.
 3. Type C: Self-adhering elastomeric butyl tape, 1/8-inch (3mm) by 3/8-inch (9mm), such as "Extru-Seal" by Pecora Corp.
 4. Type D: Type A: One component moisture cure polyether polymer sealant available in over 175 standard colors such as "Tite Bond Weather Master Sealant" by Franklin International, color to match finish/color of adjacent sheet metal.
- F. Base Material for Flashing Pans:
1. Flashing Pans 12-inch by 12-inch and Smaller: Quick-setting grout formula meeting Corps of Engineers specification CRD-C-621, Type D and ASTM C-1107, Grade C, such as "Five Star Instant Grout" by Five Star Products, Inc., "Sika Grout 212" by Sika Corp., or approved equal.
 2. Flashing Pans Larger than 12-inch by 12-inch: Spray-foam such as "FrothPak" by InstaFoam.
- G. Pourable Sealer: Single-component pourable polyurethane sealer such as "Pourable Sealer" by JM, "1-Part Pourable Sealer" by Chem-Link, or approved equal.
- H. Termination Bar: 1/8-inch (3mm) thick, 1-inch (25mm) wide extruded aluminum bar with flat profile, factory punched oval holes (1/4-inch by 3/8-inch [6mm by 9mm]) spaced 6-inches (150mm) on-center, such as "TB 125" by The TruFast Corp. or "Heavy Flat Bar" by OMG.
- I. Stainless Steel Clamp: Stainless steel banding with worm-drive tightening, sized for application such as "Make-A-Clamp Kit" by Dynamic Fastener, 800/821-5448.

2.5 FABRICATION - GENERAL

- A. Fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and approved shop drawings.
- B. Comply with material manufacturer's instructions and recommendations for forming material.
- C. Shop fabricate work to greatest extent possible. Fabricate inside and outside corners for metal edge flashings and copings from single piece with equal length legs, minimum 3 feet. Notch, lap, and seam inside and outside corners of counter flashings.
- D. Fabricate for waterproof and weather resistant performance with expansion provisions for running work sufficient to permanently prevent leakage, damage, or deterioration of work. Form work to fit substrates.
- E. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling.
- F. Form materials with straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.
- G. Fold back edges of exposed ends of sheet metal edge to form hem, 1/2-inch minimum.
- H. Lap joints 1-inch (25mm) minimum. Rivet and solder joints on parts that are to be permanently and rigidly assembled for copper, stainless, aluminum, and galvanized sheet metal. Install rivets, spaced 1-inch (25mm) on-center and apply solder to secure and seal exposed edge of sheet metal in a uniform continuous bead with smooth top finish. Clean residue upon completion of soldering process. Fabricate sheet metal assemblies so that adjoining sections are nested to achieve continuous metal-to-metal contact.
- I. Seams:
 - 1. Fabricate non-moving seams in sheet metal with flat-lock seams.
 - 2. Pre-finished Galvanized Sheet Metal: Seal pre-finished metal seams with rivets, spaced 1-inch (25mm) on-center, and silicone sealant, color to match metal finish.
 - 3. Metal Other than Aluminum: Tin edges to be seamed, form seams, and solder.
- J. Expansion Provisions: Where lapped type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with sealant concealed within joints.
- K. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant in compliance with SMACNA standards.

2.6 FABRICATED ITEMS

- A. Receivers and Counter Flashings: Minimum 24-gauge pre-finished sheet metal formed in maximum 10 foot (3m) lengths; fabricate “S”-shaped receiver to engage counter flashing a minimum of 1-inch; fabricate counter flashing with broken fascia of length to extend over top edge of base flashing a minimum of 4-inches with 1/2-inch hemmed drip edge.
- B. Wind Clips: Minimum 24-gauge pre-finished sheet metal, 1-inch (25mm) wide, length to engage counter flashing a minimum of 1/2-inch (13mm).
- C. Roof Penetration Flashing Pan and Bonnet: Minimum 24-gauge polymer-clad sheet metal. Fabricate pan with 1/4-inch (6mm) hem at top edge, 4-inch (100mm) wide horizontal flanges with rounded corners; to provide installed minimum clear inside perimeter dimension of 2-inches (50mm) on each side of penetrating element and 6-inch height. Fabricate bonnet in two-piece adjustable construction with 1/2-inch caulk trough along top edge and a skirt, with hemmed edge, of length to extend over top edge of pan a minimum of 2-inches (50mm).
- D. Angle Termination Bar: 1-inch by 1-inch (25mm by 25mm) 24-gauge galvanized sheet metal.
- E. Pipe Box (Base, Hood, and Face Plate): 24-gauge polymer-clad sheet metal. Base shall be 8-inches in height, with 4-inch wide flanges with rounded corners and sized to provide minimum 2-inch clearance between pipes and box.
- F. Cleats/Clips:
 - 1. Concealed Cleats/Clips: Continuous strips, 22-gauge sheet metal, same metal type and fascia profile as adjacent metal item, with 3/4-inch drip edge formed at a 30 degree angle with vertical wall.
 - 2. Exposed Cleats/Clips: 24-gauge pre-finished sheet metal.
- G. Heat Exhaust/Gravity Vent/Turbine Vent: 24-gauge polymer-coated sheet metal. Base shall be 8-inches in height with 4-inch wide horizontal flanges with rounded corners and hoods to conceal top of base.
- H. Curb Cap Flashing: 24-gauge stainless steel sheet metal with 4-inch vertical fascias.
- I. Low-profile Metal Edge: PVC-clad sheet metal formed in maximum 10-foot lengths, with 4-inch wide horizontal flange and 1-1/2-inch fascia with 1/2-inch hemmed kick-out.
- J. Fascia Extender: 24 gauge pre-finished sheet metal with 1/2-inch stiffening rib at mid-span with 3/4-inch drips with 5/8-inch returns at 30-degree angle with vertical wall at bottom end formed in 10-foot lengths.
- K. Gutter and Downspouts: 24 gauge pre-finished sheet metal gutter 5-inch width and 5-inch depth; downspout shall be 4-inches (100mm) by 4-inches (100mm) with seam located on back of downspout. Downspout and gutter straps shall be 1-inch wide double-hemmed pre-finished sheet metal with rounded corners; brackets to be 1/8-inch galvanized steel wrapped with prefinished sheet metal.

L. Coping:

1. Shop-fabricated Option: 24-gauge pre-finished sheet metal with 6-inch (150mm) wide cover plates of same profile. Form 3/4-inch drips with 5/8-inch returns at 30-degree angle with vertical wall at bottom end of both interior and exterior fascias complying with ANSI/SPRI ES-1 Standard, 140 mph during Test.
2. Pre-manufactured Option: Pre-manufactured prefinished sheet metal coping of designated dimensions and meeting ANSI/SPRI ES-1 requirements for 110 mph with continuous cleat installed over sloped substrate such as “Sloped Formed Coping” by Hickman Engineered Systems, “One Coping” by Metal Era, or approved equal complying with ANSI/SPRI ES-1 Standard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that substrates are smooth and clean to extent needed for sheet metal work.
- B. Verify that reglets, nails, cants, and blocking to receive sheet metal are installed and free of concrete and soil.
- C. Do not start sheet metal work until conditions are satisfactory.

3.2 INSTALLATION

- A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4-inch (6mm) hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Install prefabricated corners or transitions at changes in direction, elevation or plane, and at intersections. Locate field joints not less than 12-inches (300mm), nor more than 3 feet (1m) from actual corner. Laps for all metals, except for prefinished metal, shall be 1-inch (25mm) wide, fastened with rivets spaced 1-inch (25mm) on-center and soldered.
- B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners where possible; and set units true to line and level as indicated. Install work with laps, joints, and seams permanently watertight and weatherproof.
- C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.
- D. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating affected surfaces with elastomeric slip sheet or other permanent liquid-applied or sheet product separation at locations of contact.

- E. Continuous Cleat: At exposed edges of metal edge flashings, fascias, copings, and where required, attach continuous cleat at 6-inches (150mm) on-center with appropriate fasteners positioned on the vertical face and fastened into 2X blocking, concrete/masonry substrate, metal wall panels, or steel substrate. At a distance of 10 feet (3m) from each direction of corner, install fasteners 3-inches (75mm) on-center. Install cleat so fascia extends a minimum of 1-inch (25mm) below top of exterior wall finish.
- F. Counter Flashings:
1. Install new counter flashings under equipment housing flanges and existing or new receivers along parapet walls to extend a minimum of 4-inches below top edge of base flashing.
 2. Secure counter flashing at 6-inches (150mm) on-center with self-tapping screws.
 3. Saw-cut Reglet Mounted Assemblies: Saw cut new joint, 1/2-inch by 1-inch deep, in existing masonry/concrete where required and to install new receiver. Clean and prepare joint surfaces to receive sealant and insert receiver into joint. Secure new receiver in place with lead wedges spaced 12-inches (300mm) on-center wedged into joint. Install backer rod into saw-cut reglet and apply a continuous bead of sealant, Type B, along reglet and top edge of receiver and tool sealant to provide outward sloping finished surface. Secure counter flashing to receiver utilizing self-tapping grommetted screws spaced 6-inches (150mm) on-center.
 4. Secure receiver to equipment curbs with appropriate fasteners spaced 12-inches on-center. Install a continuous gasket on top of receiver. Secure counter flashing to receiver utilizing grommetted self-tapping screws spaced 6-inches (150mm) on-center.
 5. Install new receivers extending behind wall finish and secure vertical flange of receiver 6-inches on-center to back-up wall or metal wall panels. Extend underlayment and/or dampproofing material over vertical flange of receiver, where applicable.
 6. Lap adjacent sections of receivers and counter flashings a minimum of 4-inches (100mm). Apply a continuous bead of sealant, Type B in lap.
 7. Trim existing counter flashings at curbs and walls that are to remain to receive new flashings. Secure new counter flashing to trimmed existing flashing utilizing self-tapping screws spaced 6-inches (150mm) on-center.
 8. Install wind clips to termination bar spaced 24-inches (600mm) on-center and engage drip edge of counter flashing a minimum of 1/2-inch (13mm).
 9. Fabricate the counter flashing to form an integral closure at terminations.
- G. Penetration Pans:
1. Install compressible fill insulation between penetrating element and deck.
 2. Prime tops and bottoms of flanges of penetration pans.
 3. Pop rivet and fully solder joints in pan and flanges.

4. Install penetration pan with flanges set in a uniform bed of sealant on membrane, secure flange with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in flanges.
5. Fill penetration pan to within 1-inch (25mm) of top of pan with non-shrink grout. Clean surfaces of pan and penetrating element and fill remainder of pan with pourable sealer.
6. Install sheet metal bonnet or hood to conceal the top of the penetration pan.

H. Roof Penetration Hoods and Bonnet:

1. Install sheet metal hood or bonnet on penetrating element to cover the top of the penetration pans.
2. Round or Pipe Penetrations:
 - a. Set bonnet in sealant, Type C; utilize Type B sealant at heat sensitive areas.
 - b. Install stainless steel draw band and tighten to secure to penetration.
 - c. Seal top of bonnet with sealant, Type B.

I. Roof Drains:

1. After membrane installation, install flashing sheet and set in uniform bed of water cut off mastic at specified locations. Cut opening in membrane to match size of drain pipe opening.

J. Pipe Box:

1. Pop rivet and fully solder joints and seams in sheet metal base and hood.
2. Prime top and bottom of flanges of base.
3. Install with flanges set in sealant, secure flanges with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in.
4. Fill base with grout or spray foam to a height of 3/4 of the total pan height.
5. Fill remaining height of base with pourable sealer.
6. Install hood over base, securing to each side with self-tapping screws, and sloping down toward front of box.
7. Install face plate to cover box opening around pipe penetrations and apply sealant, Type B, around pipe configuration at face plate.

K. Gutter

1. Install brackets attached to substrate with two screws per bracket and brackets spaced 3-foot on-center.
2. Secure gutter to substrate with appropriate fastener spaced 6-inches on-center.
3. Fabricate gutter spacers spaced 3 feet (1m) on-center attached to front and back of gutter with pop rivets and staggered from brackets.
4. Lap joints in gutters 2-inches (50mm). Apply a continuous bead of sealant, Type A, between lap and install two rows of rivets spaced on 1-inch (25mm) centers, staggered. Lap joints in direction of flow of water within gutter. Apply reinforced coating or liquid flashing over lap joints and downspout connections in gutters.
5. Secure gutter to brackets with stainless steel bolt or self-tapping screw.
6. Install downspouts at designated locations. Install downspouts within 50 linear feet of gutter length, within expansion joints, or within section of gutter installed along each roof edge length of less than 50 feet.

7. Install new downspouts plumb and level and secure to wall with straps located at bottom of downspout and located at joints in downspouts. Install downspouts to conform to wall or substrate configuration.
 8. Install splash blocks under downspouts.
- L. Heat Exhaust/Gravity Vent/Turbine Vent/Goose-neck Vent:
1. Install with flanges set in sealant, secure flanges with appropriate fasteners spaced 6-inches on-center, staggered, and strip-in.
 2. At heat exhaust vents, install sheet metal bonnet secured to vent pipe with stainless steel draw band and apply sealant, Type B, along top edge of bonnet and tool sealant to provide outward sloping finished surface.
- M. Curb Cap Flashing:
1. Install new wood nailers on top of curb to provide substrate to receive cap flashing.
 2. Install and adhere underlayment/modified bitumen flashing over top of curb extending a minimum 4-inches below top of curb and overlapping top edge of base flashing.
 3. Install metal cap flashing over curb. Install appropriate fasteners through the fascia spaced 12-inches on-center.
 4. Re-install equipment on top of cap flashing on top of vibration isolator pads.
- N. Coping:
1. Install new 2X wood nailers and/or 2X wood nailers and plywood to provide substrate on top of wall to have a resulting positive slope (minimum 1-inch per foot) toward roof.
 2. Install and adhere underlayment or flashing membrane over the wood substrate extending a minimum of 1-inch below top of wall system. Lap ends minimum of 3-inches (75mm) and secure membrane in place on exterior vertical face.
 3. Install metal coping segments allowing 1/2-inch (13mm) spaces between segments. Lock coping onto cleat and install appropriate fasteners through the interior fascia spaced 24-inches (600mm) on-center in enlarged holes.
 4. Install cover plate centered over coping joint in continuous beads of sealant, Type B, placed approximately 1-inch (25mm) from cover edges.
 5. Install appropriate fastener through neoprene washer and cover plate between coping segments.
 6. Accommodate building wall expansion joints by terminating coping joints and cleats either side of expansion joint. Do not run coping or cleats continuous across joints. Install coping cover plate to span across joint and lap coping on each side of joint a minimum of 4-inches (100mm). Fasten cover plate on one side of joint only.
 7. Fabricate transitions of changes in direction, wall size, or elevation from one-piece with sealed and riveted lap seams.
 8. Install cap bead of sealant, Type B, over sealed/riveted lap seam in coping at corners. Apply tape on coping to provide straight edges of tooled cap bead. Remove tape upon completion of tooling.
 9. At terminations occurring at rise walls, install end coping section with upward vertical flange (4-inch height) and fascias that extend a minimum 4-inches onto wall. Install counter flashing/closure set in saw-cut reglet and extend over flanges of coping end cap.

3.3 CLEANING

- A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean and free of stains, scrap, and debris.
- B. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration/damage of finishes. Paint (color to match) areas of prefinished metal where finish is damaged. Replace sheet metal items when damaged finish can not be repaired to an acceptable condition.

- C. Prime soldered area of phosphatized metal after cleaning to prevent rusting.
- D. Paint with elastomeric coating, metal flashings that have been soiled with bitumen. Use medium nap roller to apply paint to surfaces to achieve monolithic finished color.

END OF SECTION 07 62 00

SECTION 079200 - JOINT SEALANTS

PART 1 - PART 1 – GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE:

- A. Submittal procedure: Section 013300.
- B. Cast-in-place concrete: Section 033000.
- C. Ceramic Tiling Section 093013

1.2 REFERENCES:

- A. ASTM C 920, Elastomeric Joint Sealants.
- B. ASTM C 962, Use of Elastomeric Joint Sealants.
- C. FS TT-S 0027EE, Sealant Compound, Elastomeric Type, Multi-component.

1.3 SYSTEM DESCRIPTION:

- A. Joint sealing is indicated as SEALANT, SEALANT AND BACKER ROD and SEALANT AND BACKUP.

1.4 SUBMITTALS:

- A. Product Data: Manufacturer's technical data for each joint sealer product required, including instructions for joint preparation and joint sealer application.
- B. Test Reports: Joint sealant-substrate laboratory test results including recommendations of joint sealer manufacturer for joint preparation and application of joint sealers applicable to project conditions. Test results of joint sealants for aged performances including hardness, stain resistance, adhesion and cohesions under cyclic movement, low-temperature flexibility, modules of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.
- C. Field test results indicating which products and joint preparation methods demonstrated acceptable adhesion to joint substrates.
- D. Certificates: Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.

1.5 QUALITY ASSURANCE:

A. Joint Sealer-Substrate Tests:

1. Transmit substrate materials representative of actual joint surfaces to be sealed to manufacturer of joint sealer products laboratory testing of sealants for adhesion to primed and unprimed substrates; provide copy of transmittal letter to Architect.

B. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealers to joint substrates under environmental conditions that will exist during actual installation.

C. Field Tests: Prior to installation of joint sealants, field-test their adhesion to joint substrates as follows:

1. Install joint sealants in 5-foot joint lengths using the same materials and methods required for completed work. Allow sealants to cure in accordance with manufacturer's recommendations before testing. Test adhesion to joint substrates by manually trying to pull sealant out of joint. Perform field tests for each type of elastomeric sealant and joint substrate application indicated.

PART 2 - PART 2 - PRODUCTS

2.1 EXTERIOR VERTICAL PLANE JOINT SEALANT:

A. Manufacturer: Master Build is specified; Sika and Pecora are acceptable, or approved equal.

1. Type: Master Builders NP 100 High Performance Hybrid

B. Joint Primer: By same manufacturer as sealant compound.

1. Color: To match adjacent surfaces with custom color mix.

2.2 INTERIOR VERTICAL PLANE JOINT SEALANT:

A. Manufacturer: Sonneborn is specified; Sika and Pecora are acceptable, or approved equal.

B. Type: Sonolac acrylic emulsion-based sealant, complying with ASTM C 920, Type S, Grade NS, Class 25.

C. Color: Submit for Architect's approval

2.3 HORIZONTAL PLANE JOINT SEALANT:

A. Manufacturer: Tremco is specified; Pecora and Vulkem are acceptable, or approved equal.

B. Type: THC-900 self-leveling sealant, complying with ASTM C 920, Type M, Grade P, Class 25; and with FS TT-S-0027EE, Type 1, Class A.

- C. Joint Primer: By same manufacturer as sealant compound.
- D. Color: Custom color to match adjacent surfaces.

2.4 BACKER ROD:

- A. Non-absorbent closed cell polyurethane or polyethylene foam rodstock, oversized to tightly fill joint, compatible with sealant materials.

PART 3 - PART 3 - EXECUTION

3.1 INSPECTION:

- A. Determine that installed work is satisfactory to receive joint sealants, proceed when conditions are satisfactory for installation of joint sealants.

3.2 INSTALLATION:

- A. Preparation: Clean joints so they are free from moisture and foreign matter at time of installation. Prime joints if recommended by manufacturer of sealant on approved submittals.
- B. Backer Rod: Install to give sealant depth and width recommended by manufacturer of sealant on approved submittals.
- C. Vertical Joints: Install with tube gun with proper size nozzle for joint.
- D. Horizontal Joints: Install with tube gun or special pouring equipment.
- E. Surface Finish: Use beading tool to remove excess material, leaving clean smooth surface free from wrinkles, ragged edges and other defects.

3.3 WORKMANSHIP:

- A. Remove and replace improperly placed and defective sealants.
- B. Defective Work Includes: Leakage, hardening, cracking, crumbling, running, staining of adjacent work by sealing; loss of adhesion to joint substrate.

3.4 JOINT SEALANT SCHEDULE:

A. JOINT SEALANT LOCATION

- 1. Interior Vertical Plane Sealant Interior joint in field-painted, vertical and overhead surfaces, at steel door frames, at gypsum drywall, concrete, and at concrete unit masonry; and all other interior locations not indicated otherwise.

2. Horizontal Plane Sealant Interior joints in horizontal surfaces between metal and concrete, mortar and masonry.

END OF SECTION 079200

SECTION 081113 - 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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.
- C. 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Field quality control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.
- B. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies shall meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:
 - 1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
 - 1. Ceco Door; AADG, Inc.; ASSA ABLOY.
 - 2. Curries, AADG, Inc.; ASSA ABLOY Group.
 - 3. Republic Doors and Frames; a Allegion brand.
 - 4. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

2.3 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. Exterior openings .
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: 16 Ga. 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 minimum R2.8
2. Frames:
- a. Materials: 16 Ga. Metallic-coated steel sheet, minimum thickness of **0.053 inch**, with minimum **A60** coating.
 - b. Construction: Full profile welded.

2.4 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.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

E. 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.

- F. 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.
- G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum **3/4 inch** beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- 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.

2.7 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. 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. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. 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.
 - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
 - 5. 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.
 - 6. 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.
- B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
 - 1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors according to NFPA 105.

- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 REPAIR

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core flush wood doors with plastic-laminate-faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 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. Door trim for openings.
5. Door frame construction.
6. Factory-machining criteria.
7. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Clearances and undercuts.

C. Samples: For plastic-laminate door faces .

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For door inspector.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.

2. Egress Door Inspector: Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
3. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with "Architectural Woodwork Standards."
1. Provide labels and certificates from AWI certification program indicating that doors and frames comply with requirements of grades specified.

2.3 SOLID-CORE FLUSH WOOD DOORS WITH PLASTIC-LAMINATE FACES

- A. Interior Doors :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. ASSA ABLOY.

- b. Curries.
- c. VT Industries Inc.
- d. Weyerhaeuser Company.
- 2. Performance Grade:
 - a. ANSI/WDMA I.S. 1A Extra Heavy Duty: All interior doors .
- 3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS .
- 4. Colors, Patterns, and Finishes: See Drawings
- 5. Exposed Vertical Edges: impact-resistant polymer edging, applied after faces.
 - a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
 - 1) Finish steel edges and astragals with baked enamel same color as doors.
 - 2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
 - d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - 1) Screw-Holding Capability: **550 lbf** in accordance with WDMA T.M. 10.
- 6. Core for Non-Fire-Rated Doors:
 - a. ANSI A208.1, Grade LD-2 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - a) **5-inch** top-rail blocking, in doors indicated to have closers.
 - b) **5-inch** bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 2) Provide doors with glued-wood-stave or WDMA I.S. 10 structural-composite-lumber cores instead of particleboard cores for doors scheduled to receive exit devices in Section 087100 "Door Hardware."
 - b. Glued wood stave.
 - c. WDMA I.S. 10 structural composite lumber.
 - 1) Screw Withdrawal, Face: **550 lbf** .
 - 2) Screw Withdrawal, Edge: **550 lbf** .
 - d. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
- 7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
 - a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

2.4 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.
 2. Comply with NFPA 80 requirements for fire-rated doors.
- 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.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Comply with applicable requirements in Section 088000 "Glazing."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of **1/8 inch in 96 inches**.
 2. Install fire-rated doors and frames in accordance with NFPA 80.
 3. Install smoke- and draft-control doors in accordance with NFPA 105.
- D. Job-Fitted Doors:
1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
 - a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
 2. Machine doors for hardware.
 3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
 4. Clearances:
 - a. Provide **1/8 inch** at heads, jambs, and between pairs of doors.
 - b. Provide **1/8 inch** from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.

- c. Where threshold is shown or scheduled, provide **1/4 inch** from bottom of door to top of threshold unless otherwise indicated.
 - d. Comply with NFPA 80 for fire-rated doors.
 - 5. Bevel non-fire-rated doors **1/8 inch in 2 inches** at lock and hinge edges.
 - 6. Bevel fire-rated doors **1/8 inch in 2 inches** at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.2 FIELD QUALITY CONTROL

- A. Inspections:
- 1. Provide inspection of installed Work through AWT's Quality Certification Program , certifying that wood doors and frames, including installation, comply with requirements of AWI/AWMCA/WI's "Architectural Woodwork Standards" for the specified grade.
 - 2. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
 - 3. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.
- B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

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 081416

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
2. Include point-to-point wiring diagrams.

C. Samples: For each type of exposed finish required.

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.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Energy Performance Certificates: NFRC-certified energy performance values from manufacturer.

B. Product test reports.

C. Source quality-control reports.

D. Field quality-control reports.

E. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. 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.

1.6 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. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked-enamel, powder-coat, or organic finishes within specified warranty period.
1. Warranty Period: 2 years from date of Substantial Completion.
- C. 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. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. EFCO Corporation.
 2. Kawneer North America, an Arconic company design basis.
 3. Oldcastle BuildingEnvelope (OBE); CRH Americas.
 4. U.S. Aluminum; a brand of C.R. Laurence.

5. 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. Interior Vestibule Framing Construction: Nonthermal .
 2. Glazing System: Retained mechanically with gaskets on four sides.
 3. Finish: As noted on drawings.
 4. Fabrication Method: Field-fabricated stick system.
 5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
- 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.

2.2 ENTRANCE DOOR SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. EFCO Corporation.
 2. Kawneer North America, an Arconic company.
 3. Oldcastle BuildingEnvelope (OBE); CRH Americas.
 4. U.S. Aluminum; a brand of C.R. Laurence.
 5. YKK AP America Inc.
- B. 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. Glazing Stops and Gaskets: Beveled , snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.3 ENTRANCE DOOR HARDWARE

- A. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door, to comply with requirements in this Section.
1. Opening-Force Requirements:

- a. Accessible Interior Doors: Not more than 5 lbf to fully open door.
 - B. Rim Exit Panic
 1. Von Duprin 99 series rim exits with 252L trim
 - C. Electric Strike
 1. HES 5000C with electric strike located above ceiling
 - D. Continuous-Gear Hinges: BHMA A156.26.
 - E. Cylinders:
 1. BHMA A156.5, Grade 1.
 - a. Provide Schlage C Key 6 pin core blank to Owner.
 - b. Owner will have core keyed by independent locksmith.
 - F. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
 - G. Operating Trim: BHMA A156.6.
 - H. Closers: BHMA A156.4, Grade 1, with accessories required for a complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.
 1. Norton 210
 - I. Door Stops: BHMA A156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.
- 2.4 GLAZING
- A. Glazing: Comply with Section 088000 "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: As recommended by manufacturer.
- 2.5 MATERIALS
- A. Sheet and Plate: **ASTM B209**.
 - B. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B221**.
 - C. Structural Profiles: ASTM B308/B308M.

- D. 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.
- E. 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.

2.6 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 exterior .
 - 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. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
- G. 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.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class 1, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 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 079200 "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.

3.2 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 088000 "Glazing."

3.3 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. 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.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanical door hardware for the following:
 - a. Swinging doors.
2. Cylinders for door hardware specified in other Sections.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product in each finish specified.
- C. Door hardware schedule.
- D. Keying schedule.

1.3 INFORMATIONAL SUBMITTALS

- A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products 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. Scheduling Responsibility: Preparation of door hardware and keying schedule.
- B. 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.
- C. 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) .

1.6 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. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
 - a. Exit Devices: Two years from date of Substantial Completion.
 - b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Where fire-rated doors are indicated, provide door hardware complying with NFPA 80 that is listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- B. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that complies with requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of **0.3 cfm/sq. ft.** at the tested pressure differential of **0.3-inch wg** of water.
- C. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. 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.
- E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design" and Texas Accessibility Standards .

2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. McKinney Products Company; an ASSA ABLOY Group company.
 - 1) Mpb #79 Finish 26D

2.3 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum **0.120-inch**- thick, hinge leaves with minimum overall width of **4 inches**; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. McKinney Products Company; an ASSA ABLOY Group company.
 - b. Pemko; an ASSA ABLOY Group Company.

2.4 MECHANICAL LOCKS AND LATCHES

- A. Yale 5400 Series
- B. Lever Trim : AU
- C. US26D Finish
- D. Lock Functions: As indicated in door hardware schedule.
- E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 - 1. Bored Locks: Minimum **1/2-inch** latchbolt throw.
 - 2. Deadbolts: Minimum **1.25-inch** bolt throw.
- F. Lock Backset: **2-3/4 inches** unless otherwise indicated.
- G. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
- H. Bored Locks: BHMA A156.2; Grade 1 ; Series 5400
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Yale Security Inc; an ASSA ABLOY Group company.
 - 1) Type AU lever
 - b. No substitutions allowed

2.5 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; ; with faceplate to suit lock and frame.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by the following
 - a. ASSA ABLOY Electronic Security Hardware; ASSA ABLOY. H.E.S. 5000C
 - b. H.E.S. 5000C
 - c. Furnish and install transformer at each opening above ceiling

2.6 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic Flush Bolts: BHMA A156.3, Type 25; minimum 3/4-inch throw; with dust-proof strikes; designed for mortising into door edge.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Rockwood by Assa Abloy
 - b. Model 2842

2.7 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Von Duprin by Allegion plc.
 - b. Surface Rim 99 Series with 252L trim
 - c. Vert Rod on Double Doors 9927 with Standard Lever trim 03 on pull side
 - d. US26D Finish

2.8 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver. Provide cylinder from same manufacturer of locking devices.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1 permanent cores; face finished to match lockset.
 - 1. Core Type: Schlage C Key 6 pin
 - a. Provide blank cores to Owner for Keying by independent contractor
- C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
- D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.9 KEYING

A. Keying System:

1. Provide cores to Johnson & Powell for keying. 8601 Jameel Road, Suite 190 Houston, Texas 77040 (713) 460-3667
2. Include cost of labor to key all locks in Base Bid
3. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - a. Provide three cylinder change keys and five each of master, grand master, and great-grand master keys.
4. Keyed Alike: Key all cylinders to same change key.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE."

2.10 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Norton Door Controls; an ASSA ABLOY Group company.
 - 1) Norton #7500 Exterior Openings
 - 2) Norton #210 Interior Openings

2.11 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Trimco.
 - b. Model 1211 Universal Floor Stop
 - c. Model 1270 Series Wall Bumpers

2.12 Overhead Stop

A. Rockwood by Assa Abloy

B. Model OH102H Heavy Duty Concealed - Hold Open

2.13 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Hager Companies.
 - b. National Guard Products, Inc.
 - c. Pemko; an ASSA ABLOY Group Company.
- B. Maximum Air Leakage: When tested according to ASTM E283 with tested pressure differential of **0.3-inch wg**, as follows:
 - 1. Smoke-Rated Gasketing: **0.3 cfm/sq. ft.** of door opening.
 - 2. Gasketing on Single Doors: **0.3 cfm/sq. ft.** of door opening.
 - 3. Gasketing on Double Doors: **0.50 cfm per ft.** of door opening.

2.14 THRESHOLDS

- A. Thresholds: BHMA A156.21; ADA fabricated to full width of opening indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Hager Companies.
 - b. National Guard Products, Inc.
 - c. Pemko; an ASSA ABLOY Group Company.

2.15 Proxy Card Reader

- A. Owner furnished and installed

2.16 FINISHES

- A. US26D unless noted otherwise

PART 3 - EXECUTION

3.1 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. Custom Steel Doors and Frames: HMMA 831.
 - 3. 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.
- 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 indicated in keying schedule .
- E. Key Control Cabinet: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
- 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.
- J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

- A. 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.

3.3 DOOR HARDWARE SCHEDULE

- A. Refer to drawings for functions to be incorporated into each opening.

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General Conditions, Supplementary General Conditions and other Division 1 Project Manual Sections, apply to work of this Section.
- B. Section 08110 Steel Doors and Frames
- C. Section 084113 Aluminum Framed Entrances and Storefronts

1.2 DESCRIPTION OF WORK:

- A. Definitions: "Glass" included both primary and fabricated glass products as described in FGMA "Glazing Manual". Glazing includes glass installation and materials used to install glass.

1.3 SYSTEM PERFORMANCES:

- A. Provide glass and glazing that has been produced, fabricated and installed to withstand normal temperature changes, wind loading, impact loading, (where applicable), without failure including loss or breakage of glass, failure of sealants or gaskets to remain materials, and other defects in the work.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.
- B. Samples: Submit, for verification purposes, 12" square samples of each type of glass indicated except for clear single pane units, and 12" long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.

1.5 QUALITY ASSURANCE:

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. FGMA Publications: "FGMA Glazing Manual."
- B. Safety Glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for Category II materials.

1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.
 - C. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.
 - D. Single Source Responsibility for Glass: Obtain glass from one source for each product indicated.
 - E. Single Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.
- 1.6 DELIVERY, STORAGE AND HANDLING:
- A. Protect glass and glazing materials during delivery, storage and handling to comply with manufacturer's directions and as required to prevent edge damage to glass, and damage to glass, and glazing materials from effects of moisture including condensation of temperature changes, of direct exposure to sun, and from other causes.

PART 2 - PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

2.2 PRIMARY GLASS PRODUCTS:

- A. 5/16" laminated interior safety impact glass for door vision panels & Interior Glass
 1. Clear+Clear
- B. Technical Glass Products 5/16" fire rated laminated glass for use in doors and sidelites
 1. FireLite Plus 90 minute rated

2.3 GLAZING SEALANTS:

- A. General: Comply with recommendations of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.
- B. Compatibility: Select sealants with proven compatibility with surfaces contacted in the installation and under service conditions indicated, as demonstrated by testing and field experience.

- C. Colors: Provide color of exposed sealants indicated or, as selected by Architect from manufacturer's standard colors.
- D. Silicone Glazing Sealant: Single component elastomeric silicone sealant complying with FS TT-S-001543, Class A, nonsag; and with ASTM C 920, Type S, Grade NS, Class 25, Use G and as applicable to use indicated, Uses A and O; and with the following requirements.
 - 1. General Electric Corporation; 1200 series silicone... Note: 1000 series is not acceptable series.

2.4 MISCELLANEOUS GLAZING MATERIALS:

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, scariness, offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass framing members.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

- A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer from metal surfaces where elastomeric sealants are indicated for use.

3.3 GLAZING GENERAL:

- A. Comply with combined printed recommendations of glass manufacturers, of manufacturers of sealants, gaskets and other glazing materials, except where more stringent requirements are indicated, including those of referenced glazing standards.
- B. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening.
- C. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

3.4 GLAZING:

- A. Install setting blocks of proper size in sill rabbet, located one quarter of glass width from each corner, but no closer than 6" unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.
- B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.
- C. Set units of glass in each series with uniformity of pattern, draw, bow and similar characteristics.

3.5 PROTECTION AND CLEANING:

- A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surface of glass. Remove nonpermanent labels and clean surfaces.
- B. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.
- C. Wash glass on both faces not more than 4 days prior to date scheduled for inspections intended to establish date of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION 088000

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Gypsum ceiling board.
3. Cementitious backer units.
4. Joint treatment materials.
5. Acoustical sealant.

B. Samples: For each texture finish indicated on same backing indicated for Work.

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 E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Certainteed; SAINT-GOBAIN.
 - b. Georgia-Pacific Gypsum LLC.

- c. National Gypsum Company.
- d. USG Corporation 1.
2. Thickness: **5/8 inch**.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Certainteed; SAINT-GOBAIN.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
2. Thickness: **5/8 inch**.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Custom Building Products - Wonderboard.
 - b. USG Corporation 1 - Durock.
2. Thickness: **5/8 inch**.
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc .
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. 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 setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound

- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.
 - 2. National Gypsum mold-resistant joint treatment "ProForm XP" .

2.7 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

- B. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C954 for fastening panels to steel members from **0.033 to 0.112 inch** thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

- C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

- D. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

- E. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

2.8 TEXTURE FINISHES

- A. Level 4 Finish

- B. Primer: As recommended by textured finish manufacturer.

- C. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following

- a. National Gypsum Company.
 - b. USG Corporation 1.
2. Texture: Orange peel .

PART 3 - EXECUTION

3.1 INSTALLATION AND FINISHING OF PANELS

- A. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- B. Comply with ASTM C840.
- C. 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.
- D. 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.
- E. Prefill open joints and damaged surface areas.
- F. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- G. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 4: Typical exposed areas.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- H. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.2 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

3.3 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic mosaic tile.
2. Glazed wall tile.
3. Tile backing panels.
4. Waterproof membrane for thinset applications.
5. Crack isolation membrane.
6. Metal edge strips.
7. ADA Marble Threshold

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.5 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide Standard-grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

- 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.

2.2 TILE PRODUCTS

A. Porcelain Tile Type F2

1. Manufacturers: Dal-Tile Corporation
2. Composition: Porcelain
3. Certifications: Porcelain tile certified by the Porcelain Tile Certification Agency
4. Module Size: 12 inches x 24 inches
5. Tile Color and Pattern: Linden Point - Color Grigio LP21
6. Grout Color: As selected by Architect from manufacturer's full range.
7. Trim Units: Manufacturer's standard trim

B. Ceramic Tile Type F6: Factory-mounted unglazed porcelain mosaic tile.

1. Manufacturers: Dal-Tile Corporation
2. Composition: Porcelain .
3. Certification: Porcelain tile certified by the Porcelain Tile Certification Agency.
4. Module Size: **2 by 2 inches** .
5. Tile Color and Pattern: Linden Point 2x2 Color Grigio LP21
6. Grout Color: As selected by Architect from manufacturer's full range .
7. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base Cove: Cove, module size **1 by 1 inch** .
 - b. Base Cap: Surface bullnose, module size **2 by 2 inches** .
 - c. External Corners for Thinset Mortar Installations: , module size **2 by 2 inches** .
 - 1) Internal Corners: Cove, module size 2 by 2 inches .
 - d. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide reduction in thickness from **1/2 to 1/4 inch** across nominal **4-inch** dimension.

C. Ceramic Tile Type W2: Glazed wall tile

1. Face Size: 12 By 24 inches .
2. Tile Color and Pattern: Linden Point Color Grigio LP21
3. Accent Tile: Crystal Shores Color Emerald Ises CS96 12" high
4. Grout Color: As selected by Architect from manufacturer's full range .

D. Accessories: Provide vitreous china accessories of type and size indicated, suitable for installing by same method as used for adjoining wall tile.

2.3 THRESHOLDS

- A. General: Marble fabricated to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to **1/16 inch** above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to **1/2 inch** or less above adjacent floor surface.

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by the following
 - a. Reference 09 29 00
 - 2. Thickness: **5/8 inch**.

2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, 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.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.

2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance 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.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Custom Building Products.
 - b. Laticrete International, Inc.
 - c. MAPEI Corporation.

2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
- B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. C-Cure.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - 2. Provide prepackaged, dry-mortar mix to which only water must be added at Project site.
 - 3. For wall applications, provide nonsagging mortar.

2.8 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. C-Cure.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - 2. Polymer Type: Dry, redispersible form, prepackaged with other dry ingredients.
- B. Grout for Pregrouted Tile Sheets: Same product used in factory to pregrout tile sheets.

2.9 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.

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.

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 waterproof membrane 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

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.

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.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: **1/8 inch**.

2. Glazed Wall Tile: 1/16 inch .

- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- K. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- L. Install tile backing panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.
- M. 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.
- N. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

3.4 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: Porcelain mosaic .
 - b. Thinset Mortar: Improved modified dry-set mortar.
 - c. Grout: High-performance unsanded grout.
- B. Interior Wall Installations, Wood or Metal Studs or Furring:
 - 1. Ceramic Tile Installation : TCNA W243; thinset mortar on gypsum board.
 - a. Thinset Mortar: Improved modified dry-set mortar.
 - b. Grout: High-performance unsanded grout.

END OF SECTION 093013

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles for interior ceilings.
2. Fully concealed, direct-hung, suspension systems.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- B. Product test reports.
- C. Research reports.
- D. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance data.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILES C1

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 1. USG
 - a. 2210 24x24

- B. Acoustical Tile Standard: Manufacturer's standard tiles of configuration indicated that comply with ASTM E1264.
- C. Color: White .
- D. Thickness: 3/4 inch .
- E. Modular Size: 24" x 24" .

2.2 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. USG Corporation.
- B. Metal Suspension-System Standard: Manufacturer's standard, direct-hung, fully concealed, metal suspension system that complies with applicable requirements in ASTM C635/C635M.
- C. Direct-Hung, Double-Web Suspension System: Main and cross runners roll formed from and capped with cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation.
 - 1. 1 1/2" Exposed Grid

2.3 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical tiles in-place during a seismic event.

2.4 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 complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated.
- B. Layout openings for penetrations centered on the penetrating items.

3.2 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. Install suspended acoustical tile ceilings according to ASTM C636/C636M and manufacturer's written instructions.
- B. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
 - 1. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- C. Arrange directionally patterned acoustical tiles as indicated on reflected ceiling plans.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Thermoplastic-rubber base.
 2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

- A. Products: Subject to compliance with requirements, provide the following
1. Roppe Corporation.
- B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).
1. Group: I (solid, homogeneous) .
 2. Style and Location:
 - a. Style B, Cove: Provide in areas with resilient floor coverings .
- C. Thickness: **0.125 inch** .
- D. Height: **4 inches** .
- E. Lengths: Coils in manufacturer's standard length .
- F. Outside Corners: Preformed .
- G. Inside Corners: Preformed .
- H. Colors: As indicated by manufacturer's designations .

2.2 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by the following
 - 1. Roppe Corporation; Roppe Holding Company.
- B. Description: Rubber carpet edge for glue-down applications nosing for resilient floor covering reducer strip for resilient floor covering joiner for tile and carpet transition strips .
- C. Colors and Patterns: As indicated by manufacturer's designations .

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.

PART 3 - EXECUTION

3.1 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.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.2 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 as long as practical without gaps at seams 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.

3.3 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.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient Tile Flooring and Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: Full-size units of each color, texture, and pattern of floor tile required.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials 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.

1.5 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.

1.6 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.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than **65 deg F** or more than **85 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 **85 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 in accordance with 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.
- B. Flooring products shall comply with the 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."
- C. Flooring products shall comply with the 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."
- D. Flooring products shall comply with the 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." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less.
- E. Flooring products shall comply with the 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."
- F. Flooring products shall comply with the 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."

2.2 SOLID VINYL FLOOR TILE : F1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Flooring; Karandean Opus
- B. Size: 6 x 36 .
- C. Thickness: 2.5mm
- D. Wear Layer: 20 mil
- E. Warranty: 15 years

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.
 - 1. Provide leveling and patching as may be required. No additional change order will be granted.
- B. Adhesives: Water-resistant type
 - 1. Karndean K99 HM - Trowel applied solvent free acrylic adhesive. Formulated to resist high amounts of moisture vapor from concrete substrate, allowing it to bond resilient flooring to substrates in conditions up to 99% RH. 11 lbs calcium chloride, and up to 12.0 pH.
 - 2. Contractor shall measure in the in-situ RH of concrete slabs in accordance with ASTM F2170, Calcium Chloride ASTM F1869, and test the pH of the slab as per ASTM F710.

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 in accordance with floor tile manufacturer's written instructions to ensure adhesion of resilient products.

- B. Concrete Substrates: Prepare in accordance with 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 10 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed **1000 sq. ft.** , and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- 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.
- 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.
- 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. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
- E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096726 - QUARTZ FLOORING

PART 1 - GENERAL

1.1 SUMMARY

1.2 Section Includes: This Section specifies broadcast quartz epoxy and polyaspartic flooring systems.

1.3 ACTION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section .

B. Manufacturer's product data, including manufacturer's SPEC-DATA product sheet.

1. Manufacturer's installation instructions.
2. Catalog pages illustrating products to be incorporated into project.
3. Material Safety Data Sheets (MSDS).

C. Samples: Submit as follows:

1. 12 inches × 12 inches (305 × 305 mm) samples of each resinous flooring system specified to show color and texture with specified coats cascaded.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Provide stock materials. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.].

1. Quantity: Provide minimum 10 % of product
2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage, and protection of extra materials.

1.5 QUALITY ASSURANCE Qualifications:

A. Manufacturer:

1. 10 years experience manufacturing components similar to or exceeding requirements of project.
2. Having sufficient capacity to produce and deliver required materials without causing delay in work.
3. Capable of providing field service representation during construction.
4. Installer: Acceptable to the manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.

PART 2 - PRODUCTS

2.1 QUARTZ FLOORING SYSTEM

A. Manufacturer: Elite Crete Systems, Inc.

1. Contact: 1151 Transport Drive, Valparaiso, IN 46383; Phone: 888-323-4445, Phone: 219-465-7671, Fax: 219-531-0898; E-mail: info@elitecrete.com; Website: www.elitecrete.com.

B. Single Source Responsibility: Provide components and materials specified in this section from a single manufacturer.

C. Substitution Limitations:

1. Substitutions: In accordance with Contract Conditions.

D. Compatibility:

1. Ensure components and materials are compatible with specified accessories and adjacent materials.

E. Quartz Broadcast Epoxy Floor Coating:

1. Primer: E-100-VB5 Epoxy Vapor Barrier.
2. Base Coat: E100-PT4 Fast Set Pigmented Epoxy
3. Color: As selected by the Architect.
4. Quartz Aggregate:
 - a. Color: As selected by the Architect
5. Top Coat: E100-PT1 Fast Set

F. Materials:

1. Primer: E100-VB5 Epoxy Vapor Barrier.
 - a. VOC Content ASTM D3960: 0 percent.
 - b. Bond Strength (ASTM D4541): Substrate failure >450 psi.
2. Base Coat: E100-PT4 Pigmented Epoxy. a. Percent Solids ASTM D3960: 100.
 - a. VOC Content ASTM D3960: 0 percent.
 - b. Compressive Strength (ASTM D645): Not less than 9500 psi. d. Tensile Strength (ASTM D638): Not less than 3000 psi.
 - c. Flexural Strength (ASTM D790): Not less than 4500 psi.
 - d. Shore D Hardness (ASTM D2240): Not less than 83 (7 days).
 - e. Color: As selected by the Architect.
3. Quartz Aggregate: Elite Crete Systems Brand
 - a. Clear Top Coat: E100-PT1 Clear Epoxy.
 - b. Percent Solids ASTM D3960: 100.
 - c. VOC Content ASTM D3960: 25 g/L (Mixed)
 - d. Compressive Strength (ASTM D645): Not less than 11,900 psi. d. Tensile Strength (D638): Not less than 2100 psi.

- e. Abrasion Resistance (ASTM D4060): Not more than 30 mg loss, CS-Wheel, 1 kg load at 1000 cycles.
- f. Flexural Strength (ASTM D790): Not less than 6200 psi.
- f. Shore D Hardness (ASTM D2240): Not less than 82 (7 days).

G. Mixes:

- 1. Mix components in accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions prior to fluid-applied flooring installation.
 - 1. Inform Architect of unacceptable conditions immediately upon discovery.
 - 2. Proceed with installation only after unacceptable conditions have been remedied [and after receipt of written approval from Architect.

3.2 PREPARATION

- A. Surface Preparation: Bead blast

3.3 APPLICATION

- A. Coordinate application of components.
 - 1. Apply components in accordance with manufacturer's written instructions.
 - 2. Single broadcast quartz aggregate.

3.4 CLEANING

- A. Perform cleanup
- B. Upon completion, remove surplus materials, rubbish, tools and equipment

3.5 PROTECTION

- A. Protect installed product from damage during construction
- B. Repair damage to adjacent materials

END OF SECTION 096726

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture required.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 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 Period: Limited Lifetime

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Manufacturers: Subject to compliance with requirements, provide products by the following

1. Interface Carpet.

B. Color: See Drawings .

- C. Pattern: Primary Stitch .
- D. Product Number: 1462102500
- E. Product Construction: Tufted Textured Loop
- F. Dye Method: 100% Solution Dyed
- G. Tufted Yard Weight: 15 oz/sq yd
- H. Machine Gauge: 1/12 in
- I. Pile Thickness: 0.079 in
- J. Size: 19.69 in x 19.69 in

2.2 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, 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.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Concrete Slabs:
 - 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 F1869. 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 F2170. 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.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 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. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer .
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. 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.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. 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.
- H. Install pattern parallel to walls and borders.
- I. 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 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Primers.
 2. Water-based finish coatings.
 3. Floor sealers and paints.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of topcoat product.
- C. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. PPG Paints; PPG Industries, Inc.
 2. Sherwin-Williams Company (The).

2.2 PAINT PRODUCTS, GENERAL

- A. 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.

B. Colors: As selected by Architect from manufacturer's full range .

2.3 PRIMERS

A. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore

B. Water-Based Rust-Inhibitive Primer: Corrosion-resistant, water-based-emulsion primer formulated for resistance to flash rusting when applied to cleaned, interior ferrous metals subject to mildly corrosive environments.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore

C. Water-Based Galvanized-Metal Primer: Corrosion-resistant, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore

D. Water-Based Bonding Primer: Water-based-emulsion primer formulated to promote adhesion of subsequent specified coatings.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).

2.4 WATER-BASED FINISH COATS

A. Interior, Latex, Flat: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore

- B. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore
 2. Gloss and Sheen Level: Manufacturer's standard eggshell finish Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523 .

- C. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore
 2. Gloss Level: Manufacturer's standard semigloss finish .

- D. Interior, Latex, High-Performance Architectural Coating, Eggshell: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore
 2. Gloss and Sheen Level: Gloss of 10 to 25 units at 60 degrees and sheen of 10 to 35 units at 85 degrees when tested in accordance with ASTM D523 .

- E. Interior, Latex, High-Performance Architectural Coating, Semigloss: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. PPG Paints; PPG Industries, Inc.
 - b. Sherwin-Williams Company (The).
 - c. Benjamin Moore

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- B. 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 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.
- C. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

3.3 INSTALLATION

- A. Apply paints according to manufacturer's written instructions.
- B. 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.

3.4 CLEANING AND PROTECTION

- A. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. 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.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:

1. Latex over Shop-Applied Quick-Drying Shop Primer System :
 - a. Prime Coat: Quick-dry primer for shop application.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, semi-gloss .

- B. Galvanized-Metal Substrates:
 1. Water-Based Light-Industrial Coating System :
 - a. Prime Coat: Cementitious galvanized primer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, water-based, light-industrial coating, semigloss .

- C. Gypsum Board Substrates:
 1. Latex over Latex Sealer System :
 - a. Prime Coat: Interior latex primer sealer.
 - b. Intermediate Coat: Matching topcoat.
 - c. Topcoat: Interior, latex, eggshell .

END OF SECTION 099123

SECTION 102113.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for blocking .
2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For 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: For each type of toilet compartment material indicated.

1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:

1. Each type of material, color, and finish required for toilet compartments, prepared on 3-inch-square Samples of same thickness and material indicated for Work.
2. Each type of hardware and accessory.

E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

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: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and Texas Accessibility Standards for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide , General Partitions; Phenolic Partitions or comparable product by one of the following:
 - 1. ASI Accurate Partitions, an ASI Group company.
 - 2. ASI Global Partitions, an ASI Group company.
 - 3. Decolam.
 - 4. Marlite.
 - 5. Scranton Products.
 - 6. Spec-Rite Designs, LLC; DesignRite Partitions.
 - 7. Weis-Robart Partitions, Inc.
- B. Toilet-Enclosure Style: Floor anchored/overhead braced with pedestal legs .
- C. Urinal-Screen Style: Wall hung .
- D. Door and Panel Height: As indicated on Drawings .
- E. Door Height Above Floor: As indicated on Drawings .
- F. Pilaster Height: As indicated on Drawings .

- G. Door Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system routed on door and adjacent pilaster. Provide minimum **3/4-inch-** thick doors. Provide door with factory predrilled hinge locations for barrel hinges.
- H. Screen and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide nominal **1/2-inch-** thick panels.
- I. Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges. Provide with integral no-sightline privacy system including profile on strike side that overlaps door. Provide nominal **3/4-inch-** thick pilasters. Provide pilaster with factory predrilled hinge locations for barrel hinges.
- J. Pilaster Shoes: Formed from stainless steel sheet, not less than **0.031-inch** nominal thickness and **3 inches** high, No. 4 satin finish. Shoe bottom enclosed and integral to compartment structure.
- K. Panel or Pilaster Pedestal Legs: Stainless steel and minimum **4 inches** high. Pedestal legs adjustable in height to within **1 inch**. Secure to floor with **2-1/2-inch-** long, corrosion-resistant screws.
- L. Brackets (Fittings):
 - 1. Continuous Type: Manufacturer's standard design; stainless steel .
- M. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: One color and pattern in each room.
 - 2. Color and Pattern: As selected by Architect from manufacturer's full range , with manufacturer's standard dark color core .
 - 3. Edge Color: Manufacturer's standard .

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
 - 1. Material: Brushed chrome-plated zamac .
 - 2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position , allowing emergency access by lifting door.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit on door for out-swinging doors and pilaster for in-swinging doors designed for occupancy indication and emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.

6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. 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, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

- A. Aluminum Extrusions: **ASTM B221**.
- B. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.
- C. Zamac: ASTM B86, commercial zinc-alloy die castings.

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. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. 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

- 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. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than two brackets attached near top and bottom of panel.
 - a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
 3. 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. Floor-Anchored Units: Set pilasters with anchors penetrating not less than **2 inches** into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware in accordance with hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging 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 102113.17

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Corner guards.
2. Handrails

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.

C. Samples: For each exposed product and for each color and texture specified, **12 inches** long.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Material certificates.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 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. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and Texas Accessibility Standards .

2.2 WALL PROTECTION

- A. Rigid Vinyl Sheet Wall Protection : Standard thickness .030 vinyl with vinyl top cap, exterior corners and interior corners.
 - 1. Designation: WP-1
 - 2. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Construction Specialties, Inc.
 - b. Inpro Corporation.
 - c. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - d. Pawling Corporation.
 - 3. Size: 3'x8' sheets
 - 4. Mounting: Surface adhered

2.3 CORNER GUARDS

- A. Surface-Mounted, Plastic-Cover Corner Guards : Manufacturer's standard assembly consisting of snap-on, resilient plastic cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.
 - 1. Designation: CG-1 (90 degree corner)
 - 2. Designation: CG-2 (End Wall Protector)
 - 3. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Inpro Corporation is basis for design
 - b. Construction Specialties, Inc.
 - c. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - d. Pawling Corporation.
 - 4. Specified:
 - a. Inpro 130
 - b. Inpro 160D
 - 5. Cover: Extruded rigid plastic, minimum 0.080-inch wall thickness; in dimensions and profiles indicated on Drawings.

- a. Color and Texture: As selected by Architect from manufacturer's full range .
6. Continuous Retainer: Minimum **0.070-inch**- thick, one-piece, extruded aluminum .
7. Retainer Clips: Manufacturer's standard impact-absorbing clips.
8. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.
9. Extend from top of wall base to ceiling.

2.4 Handrail

- A. Surface mounted handrail with 1.5 inch vinyl cover on gripping surface

1. Designation: HR-1
2. Manufacturer:
 - a. Inpro Corporation is basis for design
 - b. Construction Specialties, Inc.
 - c. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - d. Pawling Corporation.
3. Specified:
 - a. Inpro G2-910V Round with end cap returns

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, nonmagnetic stainless-steel, or other noncorrosive metal 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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation Quality: Install wall and door 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. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

- C. 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. Where splices occur in horizontal runs of more than **20 feet**, splice aluminum retainers and plastic covers at different locations along the run, but no closer than **12 inches** apart.
 - 3. Adjust end and top caps as required to ensure tight seams.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Childcare accessories.
3. Custodial accessories.
4. Special Needs Adult Changing Table

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each finish specified, full size.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.4 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Warranty for Special Needs adult changing table.
 1. Warranty Period:
 - a. 5 years manufacturing defect

PART 2 - PRODUCTS

2.1 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.

2.2 Special Needs Adult Changing Table

A. Manufacturer / Model : Pressalit 3000

1. Adult Size
2. Power Adjustable Height 12" to 38 7/8"
3. Graphite Gray Mattress
4. Table Length: 75.25 inches
5. Table Width : 31 inches
6. Weight Capacity: 440 lbs
7. Receiver tray captures fluids
8. Factory installed safety rail with easy one-handed operation
9. Adjustable head and back support
10. Hand-held remote control
11. Mounting Hardware: Included
12. Installation Instructions: <https://max-ability.com/wp-content/uploads/2022/01/Pressalit-3000-Height-Adjustable-Installation-Drawing-rev-Jan-2022-comp-opt.pdf?c=aacf2d960ac3>

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser TS2 :

1. Owner Furnished Contractor Installed
2. Description: Double-roll dispenser .
3. Mounting: Surface mounted.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

B. Paper Towel Dispenser, Sanitary Napkin Disposal, Soap Dispenser :

1. Owner furnished contractor installed
2. Mounting: Surface mounted.

C. Grab Bar TS25 :

1. **Manufacturers:** Subject to compliance with requirements, undefined
 - a. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. 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. Sanitary-Napkin Disposal Unit TS8 :

1. Mounting: Surface mounted.
2. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
3. Receptacle: Removable.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin) .

E. Mirror Unit TS22 :

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. AJW Architectural Products.
 - b. American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
2. Frame: Stainless steel angle, **0.05 inch** thick .
 - a. Corners: Manufacturer's standard .
3. Size: As indicated on Drawings .

2.4 Tack Strip

A. Map and Display Rail System

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Claridge
2. Description: Aluminum map and display rail with extrusion to hold posters, with tackable insert approx 1 5/8 inches wide
3. Length: 96 inch sections .
4. Model HT79-8

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.

SMITH BUILDING
RENOVATION

SECTION 102800 - TOILET,
BATH, AND LAUNDRY
ACCESSORIES

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for portable fire extinguishers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For fire-protection cabinets.
- C. Samples: For each type of exposed finish required.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET FEC

- A. Cabinet Type: Suitable for fire extinguisher.
 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Activar Construction Products Group, Inc. - JL Industries.

- b. Babcock-Davis.
 - c. Guardian Fire Equipment, Inc.
 - d. Larsens Manufacturing Company.
 - e. Potter Roemer LLC; a Division of Morris Group International.
- B. Cabinet Construction: Nonrated .
- C. Cabinet Material: Cold-rolled steel sheet .
- 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. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Steel sheet .
- F. Door Material: Steel 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.
- 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. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
 - 3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle .
 - 4. 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: Silk-screened .
 - 3) Lettering Color: Red .
 - 4) Orientation: Vertical .
- J. Materials:
- 1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
 - b. Color: As selected by Architect from manufacturer's full range .

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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.
- B. Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- C. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
- D. Identification: Apply decals at locations indicated.
- E. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following
 - a. Activar Construction Products Group, Inc. - JL Industries.
 - b. Babcock-Davis.
 - c. Guardian Fire Equipment, Inc.
 - d. Larsens Manufacturing Company.
 - e. Potter Roemer LLC; a Division of Morris Group International.
 - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type : UL-rated 10 LB. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.
- C. Type K (KItchen Use) 1.58 Gal / 6 Lt. wet chemical with surface mounting bracket

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dishwasher

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 DISHWASHERS

A. Dishwasher : Complying with AHAM DW-1.

1. Manufacturer: LG
2. Model: LDFN3432T
3. Type: Built-in undercounter .
4. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
 - 2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After installation, start units to confirm proper operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.
- B. An appliance will be considered defective if it does not pass tests and inspections.

END OF SECTION 113013

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil treatment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include the EPA-Registered Label for termiticide products.

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

- B. Soil Treatment Application Report: Include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

- C. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

1.5 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (*Coptotermes formosanus*). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: 1 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

- A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following
 - a. Premise 75
 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated.

3.2 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
 1. Apply in trenches cut in existing slab for sanitary plumbing line installations.
- B. Post warning signs in areas of application.

END OF SECTION 313116

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving

1. Driveways.
2. Parking lots.
3. Curbs and gutters.
4. Walks.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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.

1.3 QUALITY ASSURANCE

- A. 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").

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with **ACI 301** unless otherwise indicated.

2.2 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

- C. Reinforcing Bars: ASTM A615/A615M, **Grade 60**; deformed.
- D. Joint Dowel Bars: ASTM A615/A615M, **Grade 60** plain-steel bars. Cut bars true to length with ends square and free of burrs.
- E. 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.

2.3 CONCRETE MATERIALS

- A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C150/C150M, gray portland cement .
 - 2. Fly Ash: ASTM C618, .
 - 3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
- B. Normal-Weight Aggregates: ASTM C33/C33M, uniformly graded. Provide aggregates from a single source.
- C. Air-Entraining Admixture: ASTM C260/C260M.
- D. 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.
- E. Water: Potable and complying with ASTM C94/C94M.

2.4 CURING MATERIALS

- A. 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. Bon Tool Co.
 - b. Brickform; a division of Solomon Colors.
 - c. ChemMasters, Inc.
 - d. Dayton Superior.
 - e. Euclid Chemical Company (The); an RPM company.
 - f. Kaufman Products, Inc.
 - g. Lambert Corporation.
 - h. Laticrete International, Inc.
 - i. Master Builders Solutions.
 - 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.

2.5 RELATED MATERIALS

- A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.

2.6 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.
- B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
 - 1. Fly Ash or Pozzolan: 15 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.
- D. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
- E. Concrete Mixtures: Normal-weight concrete.
 - 1. Compressive Strength (28 Days): **3000 psi** .

2.7 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

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 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

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.
- 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.
- 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.
- 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:
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a **3/8-inch** radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. 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.
- B. Comply with **ACI 301** requirements for measuring, mixing, transporting, and placing concrete.

- C. 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.
- D. Screed paving surface with a straightedge and strike off.
- E. 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.

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. 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.

3.8 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 curing compound .

3.9 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; unlevelled straightedge not to exceed **1/2 inch**.
 - 4. Joint Spacing: **3 inches**.
 - 5. Contraction Joint Depth: Plus **1/4 inch**, no minus.

6. Joint Width: Plus $1/8$ inch, no minus.

3.10 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. 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.
- C. 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 321313

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Painted markings applied to asphalt paving.
2. Painted markings applied to concrete surfaces.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Pavement-marking paint, solvent-borne.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint, Solvent-Borne: MPI #32, solvent-borne traffic-marking paint.

1. Color: White .

PART 3 - EXECUTION

3.1 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow asphalt paving or concrete surfaces 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 asphalt paving or concrete surface.

SMITH BUILDING
RENOVATION

SECTION 321723 -
PAVEMENT MARKINGS

END OF SECTION 321723

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. Pipes, fittings, and specialties.
 2. Cover system for sprinkler piping.
 3. Specialty valves.
 4. Sprinklers.
 5. Alarm devices.
 6. Control panels.
 7. Pressure gages.
- B. Furnish all materials, labor, tools, equipment and working plans to install and place into operation the complete Fire Protection System (Automatic Wet Pipe Sprinkler System) for the entire building in accordance with the attached plans and as specified herein.
- C. All work shall meet requirements of the latest edition of the National Fire Protection Association (NFPA), Texas State Fire Marshal.
- D. Prior to start of the design of the fire protection system, the contractor shall coordinate and complete the "Owner's Information Certificate" form required by the State Fire Marshal. The form can be found at the State Fire Marshal's website. The form shall identify special occupancies and commodity classifications and shall be given to the fire protection system designer before the start of design.
- E. Sprinkler contractor shall visit site and familiarize himself with all existing conditions, examine plans and specifications to determine building conditions and coordinate with work being performed by other trades. Contractor shall make note that all calculations and plans required by the State Fire Marshal shall be provided by Sprinkler Contractor.
- F. Each bidder shall be licensed to perform sprinkler work in the State of Louisiana and shall be recognized by Property Insurance Association of Louisiana as a reliable sprinkler contractor.
- G. Sprinkler Contractor shall include in his price all offsets required in order to avoid conflict with ductwork, lights, grilles, air boxes, etc. All offsets shall be made above intersecting ducts or pipes in order to minimize trapping of water. Contractor shall coordinate installation of his piping with all other trades to assure that they can all fit in the space provided. In general, sprinkler piping shall be run at maximum height above finished floor or between joists in order to minimize conflict with different trades. In areas where joists are exposed, lines shall be run at bottom of roof deck, between or through joists.



- H. Contractor shall make note that sprinkler piping layout and sprinkler head locations are diagrammatic and all spaces shall have proper number of heads and proper pipe size in contractor's price.
- I. Contractor shall also obtain latest flow data for local utility company and assure himself prior to bid that adequate pressures and flow are available for the system he intends to provide.

1.3 REQUEST FOR APPEAL

- A. The Contractor shall be required to complete any and all "Appeals" to the State Fire Marshal's Office required to clear review comments associated with shop drawings. The Contractor shall be required to complete the Appeal Forms and provide associated appeal costs for appeals associated with the project.
 - 1. Example of Appeals including but not limited to: Sprinkler head type below stands, Low Suction Control Valve required by DHH on Fire Pump applications, etc.

1.4 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.5 painting

- A. All painting shall be by the general contractor's painting sub-contractor. All pipe, pipe covering, equipment, supports, hangers, etc. Exposed in the building or equipment room shall be painted. This contractor shall prepare the surface of the material to receive the first coat of paint.
- B. All subsequent coatings shall be prepared by the painting sub-contractor. Requirements covering paints, workmanship and preparation of surfaces as stated in the architectural specifications shall govern. Colors shall be approved by the architect. All piping shall be color-coded.
- C. All piping shall be color coded per the following:
 - 1. Fire Protection Piping (Exposed in Building) Red (Color to be selected by Architect)

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

3. Shop drawings shall be prepared by the contractor before commencing fire protection installation. The shop drawings shall be detailed as required by the State Fire Marshal's Office and submitted through the Architect to the following for approval:
 - a. State Fire Marshal.
 - b. Local Fire Prevention Bureau.
 4. Provide review application fee as required by the State Fire Marshal. Contractor shall pay all applicable fees required for the project thru completion of project.
 5. All shop drawings plans and elevations shall be made at 1/8" scale and arranged same as contract drawings.
 6. Provide scaled site plan.
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed by the qualified NICET certified designer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Domestic water piping
 2. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
- B. Qualification Data: For qualified Installer and NICET designer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Fire-hydrant flow test report.
- E. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- F. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of

sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.10 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified designer.
 - b. The contractor shall be a qualified fire protection contractor, licensed by the State of Louisiana and directly engaged in the installation of automatic fire sprinkler systems and other fire protection equipment.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.11 FIELD CONDITIONS

- ##### A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of sprinkler service.
 2. Do not proceed with interruption of sprinkler service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- ##### A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13.
- ##### B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- ##### C. Delegated Design: Engage a qualified designer to design wet-pipe sprinkler systems.
1. Conduct a fire-hydrant flow test and indicate the following conditions:
 - a. Date:
 - b. Time:
 - c. Performed by:
 - d. Location of Residual Fire Hydrant R:
 - e. Location of Flow Fire Hydrant F:
 - f. Static Pressure at Residual Fire Hydrant R:
 - g. Measured Flow at Flow Fire Hydrant F:

- h. Residual Pressure at Residual Fire Hydrant R:
- 2. Sprinkler system design shall be approved by authorities having jurisdiction.
 - a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 - b. Sprinkler Occupancy Hazard Classifications as per NFPA.
- 3. Minimum Density for Automatic-Sprinkler Piping Design as per NFPA:
- 4. Maximum Protection Area per Sprinkler: According to UL listing.

2.2 STEEL PIPE AND FITTINGS

- A. Standard-Weight, SCHEDULE 40 Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 4 to NPS 5; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- D. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
 - 1. Pipe-Flange Gasket Materials: EPDM rubber gasket.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
 - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Pressure Rating: 175-psig minimum.
 - 2. Galvanized Painted Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
 - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

- B. Pressure Rating:
 - 1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.

2.4 SPRINKLERS

- A. Manufacturers shall be one of the following:
 - 1. Viking Corporation.
 - 2. Reliable Automatic Sprinkler Co.
 - 3. Grinnel.
 - 4. Tyco Fire & Building Products.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- E. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Early-Suppression, Fast-Response Applications: UL 1767.
 - 2. Nonresidential Applications: UL 199.
 - 3. Residential Applications: UL 1626.
 - 4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
 - 5.
- F. Open Sprinklers with Heat-Responsive Element Removed: UL 199.
 - 1. Nominal Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
- G. Sprinkler Finishes: Chrome plated.
- H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- I. Sprinkler Guards:
 - 1. Standard: UL 199.
 - 2. Type: Wire cage with fastening device for attaching to sprinkler.

2.5 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Electrically Operated Alarm Bell:
 - 1. Standard: UL 464.
 - 2. Type: Vibrating, metal alarm bell.
 - 3. Size: [6-inch minimum-] [8-inch minimum-] [10-inch] diameter.
 - 4. Finish: Red-enamel factory finish, suitable for outdoor use.
 - 5. 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
- C. Water-Flow Indicators:
 - 1. Standard: UL 346.
 - 2. Water-Flow Detector: Electrically supervised.
 - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 4. Type: Paddle operated.
 - 5. Pressure Rating: 250 psig.
 - 6. Design Installation: Horizontal or vertical.
- D. Pressure Switches:
 - 1. Standard: UL 346.
 - 2. Type: Electrically supervised water-flow switch with retard feature.
 - 3. Components: Single-pole, double-throw switch with normally closed contacts.
 - 4. Design Operation: Rising pressure signals water flow.
- E. Valve Supervisory Switches:
 - 1. Standard: UL 346.
 - 2. Type: Electrically supervised.
 - 3. Components: Single-pole, double-throw switch with normally closed contacts.
 - 4. Design: Signals that controlled valve is in other than fully open position.
 - 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.6 PRESSURE GAGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0- to 250-psig minimum.
- D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

- A. Reuse existing water-service piping for service entrance to building.
- B. Reuse the existing shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
 - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.

- K. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- L. Fill sprinkler system piping with water.
- M. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors.
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system □ pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

- K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
 - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
 - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.

3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers with stainless steel braided fully welded flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid. Flexible hose shall not use gaskets and shall be true 1” hose sizes.

3.7 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Energize circuits to electrical equipment and devices.
 - 5. Coordinate with fire-alarm tests. Operate as required.
 - 6. Verify that equipment hose threads are same as local fire department equipment. Provide letter to Architect with the approval of the thread type by the local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPE HANGERS AND SUPPORTS

- A. This Contractor shall furnish and install all foundations and supports required for his equipment unless indicated otherwise on the Drawings.
- B. This Contractor shall furnish and install all escutcheons, inserts, thimbles, hangers, saddles, etc. required for the proper support and installation of his equipment and piping and he shall cooperate with other trades in locating and placing these items.

3.12 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, cast-iron threaded fittings, and threaded grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

- C. Piping within the building 4" and smaller shall be Schedule 40 black steel pipe with threaded fittings. Piping larger than 4" shall be Schedule 40 black steel pipe with welded fittings. At Contractor's option, piping larger than 4" may be Schedule 10. At Contractor's option, roll grooved pipe with mechanical couplings may be used. Schedule 5 piping is not acceptable.

3.13 MECHANICAL GROOVED PIPING

- A. At the contractor's option, roll grooved piping and fittings may be used for the Fire Protection and HVAC piping systems inside building in lieu of connections hereinbefore specified. Cut grooved piping is not acceptable.
- B. Couplings shall be fabricated in two or more parts of malleable iron castings, in accordance Federal Specification QQ-I-666c, Grade II. Couplings gasket shall be molded synthetic rubber, per ASTM-D-75-61, Grade No. R615BZ. Coupling bolts shall be oval neck track head type with hexagonal heavy nuts, per ASTM A-183-60.
- C. All pipe fittings shall be fabricated of malleable iron castings in accordance with Federal Specifications QQ-1-666c, Grade II. Where malleable fitting pattern is not available, fittings fabricated from Schedule 40 steep pipe or standard wall seamless welded fittings with grooved ends may be used.
- D. Before assembly of couplings, light coat pipe ends and outside of gaskets with cup grease or graphite paste to facilitate installation.
- E. Pipe grooving shall be in accordance with the manufacturer's specifications contained in latest published literature.

3.14 VICTAULIC COUPLINGS

- A. At the contractor's option, Victaulic couplings and fittings may be used for the Fire Protection and HVAC piping systems inside building in lieu of connections hereinbefore specified.
- B. Couplings shall be manufactured in two or more parts of ASTM A-395 grade 65-45-15 and A-536 grade 65-45-12 ductile iron castings. Coupling gaskets shall be suited for the intended service as per manufacturer's guidelines and recommendations. Coupling bolts shall be zinc-plated carbon steel track head type with hexagonal heavy nuts, per ASTM A-183-60.
- C. Rigid Couplings shall be Victaulic Style 07, FireLock™ Style 005, or equal with offsetting angle-pattern bolt pads, to provide rigidity and piping system support and hanging requirements in accordance with ANSI B31.1, B31.9, and NFPA 13.
- D. Flexible Couplings shall be Victaulic Style 75, or Victaulic Style 77, or equal: Flexible Couplings shall used in locations where stress relief and vibration attenuation are required. Couplings shall be placed in close proximity to the vibration source.
- E. Flange Adapters shall be Victaulic Style 741, or equal. Flange adapters shall be Class 150 flange adapters for grooved end pipe shall be manufactured in two or more parts of ASTM A-

395 grade 65-45-15 and A-536 grade 65-45-12 ductile iron castings. Flange adapter gaskets shall be suited for the intended service as per manufacturer's guidelines and recommendations.

- F. All pipe fittings used with pipe couplings shall be fabricated of ductile iron conforming to ASTM A-395 grade 65-45-15 and A-536 grade 65-45-12 or forged carbon steel conforming to ASTM A234 grade WPB. Where Victaulic ductile iron or forged carbon steel fitting patterns are not available, fittings fabricated from schedule 40 steel pipe conforming to ASTM A-53 with grooved ends may be used. Fittings used in fire protection service shall be UL listed and FM approved, equal to Victaulic FireLock™ fittings.
- G. Pipe ends shall be clean and free from indentations, projections, and roll marks. Before assembly of couplings, lightly coat pipe ends and outside of gaskets with lubricant, cup grease or graphite paste to facilitate installation.
- H. Pipe grooving shall be in accordance with the manufacturer's specifications contained in latest published literature.
- I. All grooved couplings, fittings and flange adapters shall be the products of the same manufacturer. Grooving tools shall be of the same manufacturer as the grooved end components.

3.15 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers with wire guards.
 - 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Spaces Subject to Freezing: Pendent, dry sprinklers.
 - 5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
 - 1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 - 2. Upright and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

SECTION 22 00 00 – PLUMBING GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

- A. The General Conditions of the Architectural Specifications, along with the supplementary conditions, special conditions, information to bidders, and any other pertinent information and documents shall apply the same as if repeated herein.



1.2 SCOPE OF WORK

- A. Furnish all labor and material necessary to provide and install the complete mechanical portion of this Contract, including plumbing systems as called for herein and on accompanying drawings. Parts of the mechanical division may be bid separately or in combination, at the Contractor's option; however, it shall be the responsibility of the General Contractor to assure himself that all items covered in the this Division have been included if he chooses to accept separate bids.
- B. This Contractor shall refer to the Architectural and Structural drawings and install equipment, piping, etc. to meet building and space requirements. No equipment shall be bid on or submitted for approval if it will not fit in the space provided.
- C. It is the intention of these Specifications that all mechanical systems shall be furnished complete with all necessary valves, controls, insulation, piping, devices, equipment, etc. necessary to provide a satisfactory installation in working order.
- D. Contractor shall visit the site and acquaint himself thoroughly with all existing facilities and conditions which would affect his portion of the work. Failure to do so shall not relieve the Contractor from the responsibility of installing his work to meet the conditions.

This Contractor shall protect the entire system and all parts thereof from injury throughout the project and up to acceptance of the work. Failure to do so shall be sufficient cause for the Architect to reject any piece of equipment.

1.3 DEMOLITION

- A. The contractor shall visit the site prior to bid to determine the extent of work required to complete the project.
- B. Contractor shall coordinate demolition with owner. The Owner shall have "First Right of Refusal" regarding salvage of all equipment and materials to be removed. Locate equipment

- as directed by owner. All equipment and materials not salvaged by the owner shall be removed from the site and discarded at the contractor's expense.
- C. Contractor shall coordinate all work with general contractor and phase work as required by project.
 - D. All equipment piping, etc. required to be removed to accommodate the modifications shall be removed.
 - E. Contractor shall maintain services to existing facilities which shall remain during and after construction is complete.
 - F. Contractor shall coordinate any shutdown of services with the owner. It is intended that the building will remain occupied during construction. Contractor shall schedule shut down of services with the owner in order to prevent disruption of building occupancy.
 - G. Contractor shall be responsible for draining down of existing systems to complete demolition. All work shall be scheduled with the owner. Contractor shall also be responsible for refilling system and removing all air in order to return the systems to proper operating conditions.
 - H. All shut down of services shall be done at night or during a time period approved by the owner. The systems shall be required to be back up and running each morning unless otherwise approved by the owner.

1.4 GROUNDS AND CHASES

- A. This Contractor shall see that all required chases, grounds, holes and accessories necessary for the installation of his work are properly built in as the work progresses; otherwise, he shall bear the cost of providing them.

1.5 CUTTING AND PATCHING

- A. Initial cutting and patching shall be the responsibility of the General Contractor, with the Mechanical Contractor being responsible for laying out and marking any and all holes required for the reception of his work. No structural beams or joists shall be cut or thimble without first receiving the approval of the Architect. After initial surfacing has been done, any further cutting, patching and painting shall be done at this Contractor's expense.

1.6 FILL AND CHARGES FOR EQUIPMENT

- A. Fill and charge with materials or chemicals all those devices or equipment as required to comply with the manufacturer's guarantee or as required for proper operation of the equipment.

1.7 MACHINERY GUARDS

- A. This Contractor shall provide v-belt guards for each v-belt drive or other hazardous drive. The guard shall enclose the drive entirely and shall have a hole for taking a tachometer reading.
- B. Provide protective guard for belts, pulleys, gears, couplings, projecting set screws, keys and other rotating parts which are located such that a person might come in close proximity. Construct protective guard around angle iron frame, securely bolted to apparatus; comply with safety requirements. Install guard to completely enclose drives and pulleys and not interfere with lubrication of equipment. Provide 2 inch minimum diameter opening in fan belt guards housing for tachometer.

1.8 REPAIRING ROADWAYS AND WALKS

- A. Where this Contractor cuts or breaks roadways or walks, in order to lay piping, he shall repair or replace these sections to meet the Architect's approval.

1.9 EXCAVATION AND BACKFILL

- A. Contractor shall perform all excavating necessary to lay the specified services. Perform excavation of every description and of whatever substance encountered to depths indicated or specified. Pile materials suitable for backfilling a sufficient distance from banks of trenches to prevent slides or cave-ins. Comply with OSHA requirements for excavation, trenching and shoring. Waste excavation materials, rubbish, etc. shall be carted away from the premises, as indicated. Remove water from trenches by pumping or other approved method, discharge at a safe distance from the excavation.
- B. Provide trenches of necessary width for proper laying of pipe and comply with latest publication of OSHA 2226 Excavating and Trenching Operations. Coordinate trench excavation with pipe installation to avoid open trenches for prolonged periods. Accurately grade bottoms of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil or the required thickness of bedding material at every point along its entire length.
- C. Provide minimum 12 inches between outer surfaces and embankment or shoring, which may be used, when excavating for manholes and similar structures. Remove unstable soil that is incapable of supporting the structure in the bottom of the excavation to the depth necessary to obtain design bearing.
- D. Material to be excavated is "unclassified". No adjustment in the contract price will be made on account of the presence or absence of rock, shale, masonry, or other materials.
- E. Protect existing utility lines that are indicated or the locations of which are made known prior to excavating and trenching and that are to be retained. Protect utility lines encountered during excavating and trenching operations, from damage during excavating, trenching and backfilling; if damaged, repair lines as directed by utilities, owner and A/E. Issue notices

when utility lines that are to be removed are encountered within the area of operations in ample time for the necessary measures to be taken to prevent interruption of the service.

- F. Provide trenches for utilities of a depth that will provide the following minimum depths of cover from existing grade or from indicated finished grades, or depths of cover in accordance with the manufacturer's recommendations, whichever is lower:
 - 1. 1-Foot Minimum Cover: Sanitary sewer, storm drainage.
 - 2. 3-Feet Minimum Cover: Domestic water, fire line.
- G. Underground domestic water piping and fire line piping shall have a 6" bed of sand below the piping and backfilled with sand to 6" above the top of piping. Select fill may be used above the sand layer.
- H. Backfill trenches after piping, fittings and joints have been tested and approved. Backfill trenches with sand to provide 6 inches of sand below piping and 12 inches of sand cover above piping.
- I. Backfill remainder of trenches with satisfactory material consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones not over 1-1/2 inches in size. Deposit backfill material in 9 inch maximum layers, loose depth as indicated or as specified. Take care not to damage utility lines.
- J. Deposit the remainder of backfill materials in the trench in 1 foot maximum layers and compact by mechanical means. Refer to architectural for minimum density for compaction (Minimum 85 percent of maximum soil density as determined by ASTM D 698). Re-open trenches and excavation pits improperly backfilled or where settlement occurs to the depth required to obtain the specified compaction, the refill and compact with the surface restored to the required grade and compaction.
- K. Backfill utility line trench with backfill material, in 6 inch layers, where trenches cross streets, driveways, building slabs, or other pavement. Moisten each layer and compact to 95 percent of the maximum soil density as determined by ASTM D 698. Accomplish backfilling in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value so that paving of the area can proceed immediately after backfilling is complete.

1.10 NOISE AND VIBRATION

- A. Provide the plumbing system and its associated components, items, piping, and equipment free of objectionable vibration or noise. Statically and dynamically balance rotating equipment and mount or fasten so that no vibration is transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional compensation.

1.11 PAINTING

- A. All painting shall be by the General Contractor or Painting Sub-Contractor. All pipe, pipe covering, equipment, supports, hangers, etc. exposed in the building or equipment room shall be painted. This Contractor shall prepare the surface of the material to receive the first coat of paint.
- B. All subsequent coatings shall be prepared by the Painting Sub-Contractor. Requirements covering paints, workmanship and preparation of surfaces as stated in the Architectural Specifications shall govern. Colors shall be approved by the Architect. All piping shall be color-coded.
- C. All piping shall be color coded per the following:
 - 1. Sanitary Sewer Waste & Vent (Exposed in Building) Black

1.12 CLEANING AND ADJUSTING

- A. Upon completion of his work, the Contractor shall clean and adjust all equipment, controls, valves, etc.; clean all piping, ductwork, etc.; and leave the entire installation in good working order.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide the Owner with three (3) copies of printed instructions indicating various pieces of equipment by name and model number, complete with parts lists, maintenance and repair instructions and test and balance report.
- B. COPIES OF SHOP DRAWINGS WILL NOT BE ACCEPTABLE AS OPERATION AND MAINTENANCE INSTRUCTIONS BUT MUST BE INCLUDED IN SUBMITTAL PACKAGE.
- C. This information shall be bound in plastic hardbound notebooks with the job name permanently embossed on the cover. Rigid board dividers with labeled tabs shall be provided for different pieces of equipment. Submit manuals to the Architect for approval.
- D. In addition to the operation and maintenance brochure, the Contractor shall provide a separate brochure which shall include registered warranty certificates on all equipment, especially any pieces of equipment which carry warranties exceeding one (1) year.
- E. The operation and maintenance brochure shall be furnished with a detailed list of all equipment furnished to the project, including the serial number and all pertinent nameplate data such as voltage, amperage draw, recommended fuse size, rpm, etc. The Contractor shall include this data on each piece of equipment furnished under this contract.

1.14 GUARANTEE

- A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the project. This guarantee shall include furnishing of all labor and material necessary to make any repairs, adjustments or replacement of any equipment, parts, etc. necessary to restore the project to first class condition. This guarantee shall exclude only the changing or cleaning of filters. Warranties exceeding one (1) year are hereinafter specified with individual pieces of equipment.

1.15 LOCAL CONDITIONS

- A. The location and elevation of all utility services is based on available surveys and utility maps and are reasonably accurate; however, these shall serve as a general guide only, and the Contractor shall visit the site and verify the location and elevation of all services to his satisfaction in order to determine the amount of work required for the execution of the Contract.
- B. The Contractor shall contact the various utility companies, determine the extent of their requirements and he shall include in his bid all lawful fees and payments required by these companies for complete connection and services to the building, including meters, connection charges, street patching, extensions from meters to main, etc.
- C. In case major changes are required, this fact, together with the reasons therefor, shall be submitted to the Architect, in writing, not less than seven (7) days before the date of bidding. Failure to comply with this requirement will make the Contractor liable for any changes, additions and expenses necessary for the successful completion of the project.

1.16 PERMITS, INSPECTIONS AND TESTS

- A. All permits, fees, etc. for the installation, inspections, plan review, service connections locations, and/or construction of the work which are required by any authority and/or agencies having jurisdiction, shall be obtained and paid for by the Contractor. This shall be verified during the bidding process.
- B. The Contractor shall make all tests required by the Architect, Engineer or other governing authorities at no additional cost to the Owner.
- C. The Contractor shall notify the Architect and local governing authorities before any tests are made, and the tests are not to be drawn off a line covered or insulated until examined and approved by the authorities. In event defects are found, these shall be corrected and the work shall be retested.
- D. Prior to requesting final inspection by the Architect, the Contractor shall have a complete coordination and adjustment meeting of all of his sub-contractors directly responsible for the operation of any portion of the system. At the time of this meeting, each and every sequence of operation shall be checked to assure proper operation. Notify the Architect in writing ten

- (10) days prior to this meeting, instructing him of the time, date and whom you are requesting to be present.
- E. This project shall not be accepted until the above provisions are met to the satisfaction of the Architect.

1.17 CODES AND STANDARDS

- A. The entire mechanical work shall comply with the rules and regulations of the City, Parish, County and the State in which this project is being constructed, including the State Fire Marshal and the State Department of Health. Modifications required by these authorities shall be made without additional charge to the Owners. The Contractor shall report these modifications to the Architect and secure his approval before work is started.
- B. In addition to the codes heretofore mentioned, mechanical work and equipment shall conform to the applicable portions of the following specifications, codes and/or regulations:
1. American Society of Heating, Refrigeration and
 2. Air Conditioning Engineers (ASHRAE)
 3. National Electrical Code (NEC)
 4. National Fire Protection Association (NFPA)
 5. American Society of Mechanical Engineers (ASME)
 6. American Gas Association (AGA)
 7. International Building Code (IBC)
 8. International Mechanical Code (IMC)
 9. International Plumbing Code (IPC)
 10. International Fuel Gas Code (IFGC)
 11. Underwriters Laboratories (UL)
 12. Life Safety Code (NFPA 101)
 13. State Sanitary Code
 14. Louisiana State Uniform Construction Code Council (LSUCCC)
 15. Facility Guidelines Institute "Guidelines for Design and Construction of Hospitals and Outpatient Facilities" (2014 Edition)
- C. Materials, equipment and accessories installed under this Contract shall conform to the rules, codes, etc. as recommended by National Associations governing the manufacturer, rating and testing of such materials, equipment and accessories. Materials shall be new and of the best quality and first class in every respect. Whenever directed by the Architect, the Contractor shall submit a sample for approval before proceeding.
- D. Where laws or local regulations provide that certain accessories such as gauges, thermometers, relief valves and parts be installed on equipment, it shall be understood that such equipment be furnished complete with the necessary accessories, whether or not called for in these Specifications.
- E. Unfired pressure vessels shall be built in accordance with the A.S.M.E. Code and so stamped. Furnish shop certificates for each vessel.

1.18 REVIEW OF MATERIALS

- A. Whenever manufacturers or trade names are mentioned in these Plans or Specifications, the words "or approved equivalent" shall be assumed to follow whether or not so stated. Manufacturers or trade names are used to establish a standard of quality only, and should not be construed to infer a preference. Equivalent products which meet the Architect's approval will be accepted; however, these products must be submitted to the Architect a minimum of seven (7) days prior to the Bid Date.
- B. Submission shall include the manufacturer's name, model number, rating table and construction features.
- C. Upon receipt and checking of this submittal, the Architect will issue an addendum listing items which are approved as equivalent to those specified. **THE CONTRACTOR SHALL BASE HIS BID SOLELY ON THOSE ITEMS SPECIFIED OR INCLUDED IN THE "PRIOR APPROVAL ADDENDUM", AS NO OTHER ITEM WILL BE ACCEPTABLE.**
- D. Prior approval of a particular piece of equipment does not mean automatic final acceptance and will not relieve the Contractor of the responsibility of assuring himself that this equipment is in complete accord with the Plans and Specifications and that it will fit into the space provided. Shop drawings must be submitted on all items of equipment for approval as hereinafter specified.
- E. Before proceeding with work and/or within thirty (30) days after the award of the General Contract for this work, the Mechanical Contractor shall furnish to the Architect complete shop and working drawings of such apparatus, equipment, controls, insulation, etc. to be provided in this project. These drawings shall give dimensions, weights, mounting data, performance curves and other pertinent information.
- F. The Architect's approval of shop drawings shall not relieve the Contractor from the responsibility of incorrectly figured dimensions or any other errors which may be contained in these drawings. Any omission from the shop drawings or specifications, even though approved by the Architect, shall not relieve the Contractor from furnishing and erecting same.
- G. Six (6) sets of shop drawings shall be submitted to the Architect for approval. These submittals shall be supplied as part of this Contractor's contract. Any drawings not approved shall be resubmitted until they are approved.
- H. This information shall be bound in plastic hardbound notebooks with the job name permanently embossed on the cover. Rigid board dividers with labeled tabs shall be provided for different pieces of materials and equipment. Submit shop drawings to the Architect for approval. Faxed copies submissions will not be accepted.

1.19 MINOR DEVIATIONS

- A. Plans and detail sketches are submitted to limit, explain and define conditions, specified requirements, pipe sizes and manner of erecting work. Structural or other conditions may require certain modifications from the manner of installation shown, and such deviations are permissible and shall be made as required. However, specified sizes and requirements necessary for satisfactory operation shall remain unchanged. It may be necessary to shift ducts or pipes, or to change the shape of ducts, and these changes shall be made as required. All such changes shall be referred to the Architect and Engineer for approval before proceeding. Extra charges shall not be allowed for these changes. The contractor shall obtain a full set of plans and specifications for the coordination of his work prior to bidding this project. Items which are unclear to the bidding contractor shall be brought to the Architect and Engineers attention prior to bidding the project. An interpretation shall be clarified by the Architect and/or the Engineer prior to bidding.
- B. The Contractor shall realize that the drawings could delve into every step, sequence or operation necessary for the completion of the project, without drawing on the Contractor's experience or ingenuity. However, only typical details are shown on the Plans. In cases where the Contractor is not certain about the method of installation of his work, he shall ask for details. Lack of details will not be an excuse for improper installation.
- C. In general, the drawings are diagrammatic and the Contractor shall install his work in a manner so that interferences between the various trades are avoided. In cases where interferences do occur, the Architect is to state which item was first installed.

1.20 AS-BUILT RECORD DRAWINGS

- A. The Contractor shall obtain at his cost, two sets of blue line prints of the original bid documents by the Architect. One set shall be kept on the site with all information as referenced below, and shall update same as the work progresses. The other set will be utilized to record all field changes to a permanent record copy for the Owner.
- B. If the Contractor elects to vary from the Contract Documents and secures prior approval from the Architect for any phase of the work, he shall record in a neat and readable manner, ALL such variances on the blackline print in red. The original blackline prints shall be returned to the Architect for documentation.
- C. All deviations from sizes, locations, and from all other features of the installations shown in the Contract Documents shall be recorded.
- D. In addition, it shall be possible using these drawings to correctly and easily locate, identify and establish sizes of all piping, directions and the like, as well as other features of the work which will be concealed underground and/or in the finished building.
- E. Locations of underground work shall be established by dimensions to columns, lines or walls, locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.

- F. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases this may be by dimension. In others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. The Architect's/Engineer's decision in this matter will be final.
- G. The following requirements apply to all "As-Built" drawings:
1. They shall be maintained at the Contractor's expense.
 2. All such drawings shall be done carefully and neatly, and in a form approved by the Architect/Engineer.
 3. Additional drawings shall be provided as necessary for clarifications.
 4. These drawings shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by the Architect/Engineer; and when necessary, to establish clearances for other parts of the work.
 5. "As-built" drawings shall be returned to the Architect upon completion of the work and are subject to approval of the Architect/Engineer.

1.21 REQUIRED SHOP DRAWING SUBMITTALS

- A. Provide the following shop drawing submittals:
1. Pipe insulation.
 2. All Valves.
 3. Plumbing fixtures and trim.
 4. Pipe and pipe fittings.
 5. PVC jacket color samples.
 6. Backflow preventors.

PART 2 PRODUCTS

2.1 PLUMBING PRODUCTS

- A. Refer to individual Division 22 sections for plumbing products, pipe, tube and fitting materials and joining methods.

PART 3 EXECUTION

3.1 MANUFACTURER'S DIRECTION

- A. The contractor shall install and operate equipment and material in accordance with the manufacturer's installation and operating instructions. The manufacturer's instructions of

installation and operation shall become part of the Contract Documents and shall supplement the Drawings and Specifications.

- B. Store equipment in a clean, dry place protected from other construction. While stored, maintain factory wrapping or tightly cover and protect equipment against dirt, water, construction debris, chemical, physical or weather damage, traffic and theft.

3.2 EQUIPMENT LABELS

- A. Provide equipment labels for water heaters and mixing valves. Labels shall have permanent laminated construction secured to equipment.

3.3 PIPE LABELS

- A. Provide pipe markers and directional arrows on all piping in mechanical equipment rooms, or which is exposed in building, and on both sides of all valves located above ceiling. Markers shall be as manufactured by W.H. Bradley Co., Marking Services Inc. or the equivalent. All letters shall be color-coded and sized as recommended by OSHA. Samples of the type of letters to be used shall be submitted with shop drawings. Piping shall be color-coded.
- B. Pipe markers with arrows shall indicate lines content and shall be located 20 feet on center and at each change of direction of line. Identification bands shall be color coded to match pipe markers and shall be provided 10 feet on center. Pipe identification markers shall be taped at each end and shall be taped around the entire circumference of pipe.
- C. The following Piping shall be identified:
 - 1. Domestic Cold Water
 - 2. Domestic Hot Water
 - 3. Sanitary Vent
 - 4. Condensate Drain

3.4 ACCESS DOORS:

- A. Provide access doors in walls, floors and ceilings to permit access to equipment and piping requiring service or adjustment.
 - 1. Valves.
 - 2. Plumbing drainage cleanouts.
 - 3. Other Plumbing equipment indicated in schedules or specifications which are requiring maintenance, adjustment or operation.

- B. Provide hinged access doors and frames as follows:
1. Drywall Construction:
 - a. Provide with concealed spring hinges and flush screwdriver operated cam locks in sufficient number of the size of the panel.
 - b. Provide prime paintable surface (not galvanized).
 - c. Product: Milcor “Style M” (Karp DSC-214M).
 2. Visible Masonry and Ceramic Tile:
 - a. Milcor “Style M” (Karp DSC-214M).
 3. Cement Plaster:
 - a. Milcor “Style K” (KarpDSC-214 PL).
 4. Acoustical Plaster:
 - a. Reinforced panel as required to prevent sagging. Provide continuous steel piano type hinge for the length of the panel, and sufficient number for the size of the panel. Provide factory prime paint surface (not galvanized).
 - b. Product: Milcor “Style AP” (Karp 214 PL).
 5. Acoustical Tile:
 - a. Milcor “Style AT” (Larsen L-CPA).
- C. Provide continuous concealed hinges and cam locks.
- D. Provide UL listed 1-1/2 hour label “B” access doors with automatic self-closing latching mechanism where required.
- E. Provide removable ceiling access tile section immediately adjacent to each mechanical or electrical device located in the ceiling plenum above removable tile ceiling.
- F. Coordinate approval of type, color and location of access doors & frames with Architect.

3.5 CLEANING AND SERVICE

- A. Upon Completion of this work, the contractor shall clean and adjust equipment, controls, valves, etc.;
- B. Clean piping, fixtures, cleanout covers, floor drain covers, etc. and leave the entire installation in good working order.
- C. Adjust flush valves and faucets to allow for proper operation.

END OF SECTION 22 00 00

SECTION 22 05 23 – GENERAL DUTY VALVES FOR PLUMBING

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 the furnishing and installation of general duty valves for plumbing:

1.3 DEFINITIONS

- A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.
 - 1. Certification that products comply with NSF 61 Annex G and NSF 372 (lead free).

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and soldered ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
 2. ASME B16.1 for flanges on iron valves.
 3. ASME B16.5 for flanges on steel valves.
 4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 5. ASME B16.18 for solder-joint connections.
 6. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
- D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
- E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- G. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
 2. Hand lever: For quarter-turn valves smaller than NPS 4.
- H. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
 2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
 3. Memory stops that are fully adjustable after insulation is applied.

2.2 MANUFACTURERS

- A. Valves shall be manufactured by one of the following:
1. Kitz.
 2. Red & White.
 3. Nibco.
 4. Kennedy.
 5. Crane.
 6. Milwaukee.
 7. Keystone.
 8. Stockham.
 9. Grinnell.
 10. Mueller.
 11. Jamesbury.
 12. DeZurik.
 13. Hammond.
 14. Apollo.

2.3 BRONZE BALL VALVES

- A. Two-Piece, Bronze Ball Valves with Full Port and Brass Trim:

1. Kitz 59/69, Apollo 77C, NIBCO Design S-580-70, Milwaukee BA-150-S, Red & White 5049F or equal, threaded ends of heating hot water and low pressure steam of Kitz 58/68, Apollo 77CLF, NIBCO Design T-580-70, Milwaukee BA-100-S, Red & White 5044F or equal. For insulated piping systems, provide ball valves with extended stem, insulated handle with protective thermal barrier sleeve to prevent condensate moisture drip and pipe insulation deterioration.
- 2.
3. Description:
 - a. Standard: MSS SP-110.
 - b. CWP Rating: 600 psig.
 - c. SSP Rating: 150 psi.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded and soldered.
 - g. Seats: PTFE.
 - h. Stem: Brass. Blow-out proof.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.
 - k. Vinyl covered steel handle.
 - l. Lead Free.
 - m. Conforms to ASTM B-62.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown. Unions are not required on flanged devices.
- B. Locate valves for easy access and provide separate support where necessary.

- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install valve tags.
- F. All valves, unions, etc. where pipe is chrome plated shall have similar finish. All exposed supplies to plumbing fixtures shall be chrome plated.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
- B. All gas cocks, valves, etc. on gas lines shall have local utility company and AGA approval.
- C. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Solder ends, except provide threaded ends for heating hot water.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends or grooved ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Grooved end or Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Grooved end or Flanged ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 3 and Smaller (above grade):
 - 1. Two-piece, bronze ball valves with full port and brass trim.
- B. Domestic water valves (below grade):
 - 1. M & H AWWA Series C-509, NIBCO T113 (3/4" to 2"), NIBCO T619 (2-1/2" and above) resilient gate valve with low torque operation, positive shut-off, O- Ring seals, full epoxy coating and square valve stem end.
 - 2. Provide two (2) adjustable "TEE" handle valve wrenches to be turned over to the owner after construction is complete.

END OF SECTION 22 05 23

SECTION 22 07 19 – PLUMBING PIPING 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 insulating the following plumbing piping services:
 1. Domestic cold-water piping.
 2. Domestic hot-water piping.
 3. Sanitary drain piping receiving condensate.
 4. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated and for each application. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory- and field-applied, if any).

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

- B. Reject damaged, deteriorated, wet, or contaminated material and immediately remove from the site. Replace removed materials at no additional cost to Owner.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Insulation:
 - 1. Pittsburgh-Corning.
 - 2. Owens- Corning.
 - 3. Certainteed.
 - 4. Armacell.
 - 5. Rubatex.
 - 6. Knauf.
 - 7. Johns Manville.
- B. Jacketing:
 - 1. Ceel-Co.
 - 2. O'Brien.
 - 3. Zeston.
 - 4. Childers.
 - 5. Pabco.
- C. Adhesives:
 - 1. Benjamin Foster.
 - 2. Childers.
 - 3. Vimasco.
 - 4. B.E.H.

2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Density of 5.0 lbs/cubic foot.
 - 2. K factor of 0.27 at 75 degrees F mean.
 - 3. Maximum water vapor transmission of 0.17 per inch.
 - 4. Must be listed for 25/50 flame/smoke spread of thickness used.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Preformed Pipe Insulation: Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. All-service jacket ASJ-SSL type factory applied jacketing.
 - 2. 6 lbs/cu ft minimum density.
 - 3. k-factor of 0.31 maximum at 200 degrees F mean.
 - 4. 850 degree F service temperature.
 - 5. 0.02 perm maximum Jacket permeance.

2.3 PIPE AND FITTING COVERS

- A. Polyvinyl Chloride (PVC) Covers:
 - 1. Ultraviolet resistant.
 - 2. 0.020 inch minimum thickness.
 - 3. Preformed to match outer diameter of insulation.
 - 4. Preformed fitting covers, minimum 10 mil.
- B. Aluminum (A) Covers:
 - 1. ASTM B209, Alloy 3003 minimum.
 - 2. 0.016-inch thickness.

3. Bright anodized or acrylic-coated smooth finish on exposed side.
4. 2-piece tee and ribless elbow covers in minimum 0.016-inch, preformed.
5. Provide moisture barrier backing and butt-joint with mastic seal for joining of adjacent sections.

2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 MASTICS

- A. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
 1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 2. Service Temperature Range: 0 to 180 deg F.
 3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 4. Color: White.

2.6 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 3. Service Temperature Range: 0 to plus 180 deg F.
 4. Color: White.

2.7 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.10 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy.

2.11 PROTECTIVE SHIELDING GUARDS

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.

- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.

2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
 4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
- 1.
 2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
1. Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

- B. Domestic Hot and Recirculated Hot Water Mains:
 - 1. NPS 2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - 2. NPS 2-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- C. Domestic Hot Water Supply and Return runouts (up to NPS 2 and not exceeding 12 feet in length from fixture shutoff valve back toward main line):
 - 1. NPS 2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- D. Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities (Handicapped Lavatory & Sinks P-Trap & Supply Lines):
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Insulate p-trap, tailpiece and water supplies on handicapped lavatories with white, Truebro Model 102, Zurn 8947 handi lav-guard, or approved equivalent insulating system to meet A.D.A. Requirements. Provide accessories for offset tailpiece as required.
- E. Floor Drains, Traps, and aboveground Sanitary Drain Piping receiving HVAC condensate:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber, 3/4 lb density, ductwrap insulation with aluminum foil vapor barrier, Type I: 2 inch thick.
- F. Exposed Domestic Cold and Hot Water Piping.
 - 1. All exposed domestic cold and hot water piping shall also have field install PVC jacket.
- G. Sewer Waste and Vent Piping:
 - 1. Where Contractor elects to use schedule 40 PVC waste and vent piping (in lieu of cast iron piping) (exposed, in furrings, or above ceilings) (vertical and horizontal lines) shall be insulated with 2" thick 3/4 # density fiberglass ductwrap insulation with aluminum foil vapor barrier. Insulation shall be sealed at all seams and joints. Insulation shall be installed with a foil backed adhesive tape around the diameter of the pipe with insulation at 24" on center intervals.

3.12 INDOOR, PIPING WITHIN CMU BLOCK WALLS PIPING INSULATION SCHEDULE

- A. Domestic cold water, hot water and condensate drain lines shall be insulated with 1/2" thick flexible closed cell elastomeric thermal tube insulation as manufactured by Armaflex AP, Rubatex or prior approved equal. All joints are to be firmly butted together. All lap and butt joint strips are to be sealed in place with vapor barrier adhesive. Fittings are to be mitered segments of insulation held in place with vapor barrier sealant. Engineered Polymer Foam Insulation (EPFI) will not be accepted.

3.13 INDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Domestic cold and hot water lines run below slab within building shall be insulated with 1/2" thick flexible closed cell elastomeric thermal tube insulation as manufactured by Armaflex AP, Rubatex or prior approved equal.
- B. All joints are to be firmly butted together. All lap and butt joint strips are to be sealed in place with vapor barrier adhesive. Fittings are to be mitered segments of insulation held in place with vapor barrier sealant.
- C. Engineered Polymer Foam Insulation (EPFI) will not be accepted.
- D. Apply two (2) coats of mastic on insulation.

3.14 OUTDOOR, ABOVE GROUND PIPING INSULATION SCHEDULE

- A. All water lines on the outside of the building exposed to the weather shall be insulated with 1/2" thick flexible closed cell elastomeric thermal tube insulation as manufactured by Armaflex AP, Rubatex or prior approved equal.
- B. All joints are to be firmly butted together. All lap and butt joint strips are to be sealed in place with vapor barrier adhesive. Fittings are to be mitered segments of insulation held in place with vapor barrier sealant.
- C. Engineered Polymer Foam Insulation (EPFI) will not be accepted.
- D. Apply two (2) coats of mastic on insulation.
- E. Lines shall be covered with 0.016 smooth aluminum jacket and elbows. At contractor's option, in lieu of 0.016 aluminum jacket, the contractor may use Venture Clad 1577CW multi-layered laminate coated, acrylic pressure sensitive adhesive jacket system.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 22 07 19

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 combined water service and fire-service mains.
- 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.
- G. NSF Compliance:
 - 1. Comply with NSF 14 for plastic potable-water-service piping. Include marking "NSF-pw" on piping.
 - 2. Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

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. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of water-distribution service without Architect's written permission.

1.10 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: 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.
 2. Copper, Pressure-Seal Fittings:
 - 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:
 - 2) Elkhart Products Corporation.
 - 3) Mueller Industries, Inc.
 - 4) Viega LLC.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- B. Hard Copper Tube: 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.
 2. Copper, Pressure-Seal Fittings:
 - 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:
 - 2) Elkhart Products Corporation.
 - 3) Mueller Industries, Inc.
 - 4) Viega LLC.
 - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
 - c. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 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.

2.3 JOINING MATERIALS

- A. Refer to Section 330500 "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.

2.4 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.
 - c. Hays Fluid Controls.
 - d. JCM Industries, Inc.
 - e. 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. Center-Sleeve Material: Manufacturer's standard.
 - c. Gasket Material: Natural or synthetic rubber.
 - d. Pressure Rating: 200 psig minimum.
 - e. Metal Component Finish: Corrosion-resistant coating or material.
- C. Split-Sleeve Pipe Couplings:
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. 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 Material: Carbon steel.
 - c. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
 - d. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
 - e. Pressure Rating: 200 psig minimum.
 - f. 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: 300 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: 150 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.

2.5 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:

1. Standards: ASTM A 674 or AWWA C105.
2. Form: Tube.
3. Material: LLDPE film of 0.008-inch minimum thickness.

4. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, crosslaminated PE film of 0.004-inch minimum thickness.
5. Material: High-density, crosslaminated PE film of 0.004-inch minimum thickness.
6. Color: Black.

2.6 GATE VALVES

A. AWWA, Cast-Iron Gate 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. American Cast Iron Pipe Company.
 - b. Crane; Crane Energy Flow Solutions.
 - c. M & H Valve Company; a division of McWane, Inc.
 - d. Mueller Co.
 - e. NIBCO INC.
 - f. 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Cast Iron Pipe Company.
 - b. Crane; Crane Energy Flow Solutions.
 - c. M & H Valve Company; a division of McWane, Inc.
 - d. Mueller Co.
 - e. NIBCO INC.
 - f. U.S. Pipe and Foundry Company.
 - g. 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane; Crane Energy Flow Solutions.
 - b. Milwaukee Valve Company.
 - c. NIBCO INC.
 - d. Stockham; Crane Energy Flow Solutions.
 - e. 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.

2.7 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. Flowserve Corporation.
 - c. Kennedy Valve Company; a division of McWane, Inc.
 - d. M & H Valve Company; a division of McWane, Inc.
 - e. Mueller Co.
 - f. 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, metal-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.

2.8 CHECK VALVES

A. AWWA Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Cast Iron Pipe Company.
 - b. Crane; Crane Energy Flow Solutions.
 - c. M & H Valve Company; a division of McWane, Inc.
 - d. Mueller Co.
 - e. NIBCO INC.
 - f. 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. Crane; Crane Energy Flow Solutions.
 - c. Mueller Co.
 - d. NIBCO INC.

- e. [United Brass Works, Inc.](#)
- 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.

2.9 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. [Mueller Co.](#)
 - c. [Victaulic Company.](#)
 - d. WATTS.
 - e. [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.

2.10 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. Body Type: Wafer or flanged.
- d. Pressure Rating: 150 psig.

B. UL Butterfly Valves:

1. [Manufacturers:](#) Subject to compliance with requirements, provide products by one of 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.](#)

2. Description: Metal on resilient material seating.

- a. Standards: UL 1091 and FMG approved.
- b. Body: Cast or ductile iron.
- c. Body Type: Wafer or flanged.
- d. Pressure Rating: 175 psig.

2.11 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.

2.12 CORPORATION VALVES AND CURB VALVES

A. Manufacturers:

- 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. [A.Y. McDonald Mfg. Co.](#)
 - b. [Amcast Industrial Corporation.](#)
 - c. [Ford Meter Box Company, Inc. \(The\).](#)
 - d. [Jones, James Company.](#)
 - e. [Master Meter, Inc.](#)
 - f. [Mueller Co.](#)
 - g. [Red Hed Manufacturing Company; a division of Everett J. Prescott, Inc.](#)

B. Service-Saddle Assemblies: Comply with AWWA C800. Include saddle and valve compatible with tapping machine.

- 1. Service Saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
- 2. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.
- 3. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

C. Curb Valves: Comply with AWWA C800. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

D. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

- 1. Shutoff Rods: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.13 BACKFLOW PREVENTERS

A. Double-Check, Detector-Assembly Backflow Preventers:

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. Ames Fire & Waterworks; A WATTS Brand.
 - b. WATTS.
 - c. Wilkins.
 - d. 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.
5. Size: 6”.
6. Body: Stainless steel.
7. End Connections: Flanged.
8. Configuration: Designed for horizontal, straight through flow.
9. Accessories:
 - a. Valves: UL 262, FMG-approved, OS&Y gate type with flanged ends on inlet and outlet.
 - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

B. Backflow Preventer Test Kits:

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. WATTS.
 - b. Wilkins.
 - c. Zurn Industries, LLC.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.14 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Hot Box: Hubbell Power Systems, Inc HB4E with two (2) 1,900 watt heater.
 - b. Safe-T Cover 400T-AL with one (1) 1,000 watt heater.
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 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 heater with self-limiting temperature control.

B. Enclosure Bases:

1. Description: 4-inch- minimum thickness reinforced concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.15 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Mueller Co.
 - b. U.S. Pipe and Foundry Company.
2. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - a. Standard: AWWA C502.
 - b. Pressure Rating: 150 psig minimum.
3. Description: Freestanding, with one NPS 4-1/2 and two NPS 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
 - a. Standards: UL 246, FMG approved.
 - b. Pressure Rating: 150 psig minimum.
 - c. Outlet Threads: NFPA 1963, with external hose thread used by local fire department. Include cast-iron caps with steel chains.
 - d. Operating and Cap Nuts: Pentagon, 1-1/2 inches point to flat.

- e. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
- f. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.

2.16 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

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. Guardian Fire Equipment, Inc.
 - b. Potter Roemer LLC.
 - c. 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.
 - a. Standard: UL 405.
 - b. Connections: Two NPS 2-1/2 inlets and one NPS 4 outlet.
 - c. Inlet Alignment: Inline, horizontal.
 - d. Finish Including Sleeve: Polished bronze.
 - e. Escutcheon Plate Marking: "AUTO SPKR."

2.17 ALARM DEVICES

- A. Alarm Devices, General: UL 753 and FMG approved, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with 2 single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Section 312000 "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 the following:
 - 1. PVC, Schedule 40 pipe; PVC, Schedule 40 socket fittings; and solvent-cemented joints.
- F. Aboveground Water-Service Piping NPS 3/4 to NPS 3 shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
- G. Underground Fire-Service-Main Piping NPS 4 to NPS 12 shall be the following:
 - 1. PVC, AWWA Class 150 pipe listed for fire-protection service; PVC Class 150 fabricated or molded fittings; and gasketed joints.
- H. Aboveground Fire-Service-Main Piping NPS 4 to NPS 12 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, high-pressure, 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 aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising 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 330500 "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 § "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, with top at least 12 inches below level of maximum frost penetration, and according to the following:
1. Under Driveways: With at least 36 inches cover over top.
- 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 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- N. Mechanical sleeve seals are specified in Section 220517 "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 211313 "Wet-Pipe Sprinkler Systems," for fire-suppression-water piping inside the building.
- Q. See Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

- A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.
- B. Make pipe joints according to the following:
 - 1. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.
 - 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.
 - a. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
 - b. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
 - c. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

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.

- 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. Install full-size valved bypass.
- 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. Install water meters, piping, and specialties according to utility company's written instructions.

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 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.

3.16 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.

3.17 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.

3.18 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install ball drip valves at each check valve for fire department connection to mains.
- B. Install protective pipe bollards on two sides of each fire department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.19 ALARM DEVICE INSTALLATION

- A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
- B. Supervisory Switches: Supervise valves in open position.
 - 1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
 - 2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
- C. Locking and Sealing: Secure unsupervised valves as follows:
 - 1. Valves: Install chain and padlock on open OS&Y gate valve.
 - 2. Post Indicators: Install padlock on wrench on indicator post.
- D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
- E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.
- F. Connect alarm devices to building fire alarm system. Wiring and fire-alarm devices are specified in Section 283111 "Digital, Addressable Fire-Alarm System" and Section 283112 "Zoned (DC Loop) Fire-Alarm System."

3.20 CONNECTIONS

- A. See Section 330500 "Common Work Results for Utilities" for piping connections to valves and equipment.
- B. Connect water-distribution piping to existing water meter
- C. Connect water-distribution piping to interior domestic water and fire-suppression piping.
- D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- E. Connect wiring according to Section 260519 "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 312000 "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 330500 "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 – DOMESTIC WATER 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. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For piping, transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" 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 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- C. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Lead free Solder-joint.

2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
 - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
 - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 TRANSITION FITTINGS

- A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

2.5 AT CONTRACTOR'S OPTION, PEX TUBE AND FITTINGS

- A. PEX Distribution System: ASTM F 877, SDR 9 tubing.
- B. Fittings for PEX-a Tube:
 - 1. Metal insert Crimp ASTM F 1807: metal-insert type with copper or stainless-steel crimp rings and matching PEX-a tube dimensions.
 - 2. Cold Expansion ASTM F 1960: Lead-free brass or engineered polymer (EP) fittings manufactured by the pipe manufacturer, utilizing cold-expansion PEX-a reinforcing rings made of same material as the pipe. Fittings shall be third party certified to NSF-14, and ASTM-F1960 and shall comply to ASTM-F876 & ASTM-F877.
 - a. Flanges: ASME B16.5, Class 150, with ASTM F1960 cold-expansion end.
 - b. Groove Adapter: One CSA B242-05 groove end and one ASTM F1960 cold-expansion end.
 - c. Press: PEX-a to Press One-piece lead free (LF) brass fitting with one ASME B16.51 copper press end and one ASTM F1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
- C. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
 - 1. Standard: ASSE 1079.
 - 2. Pressure Rating: 150 psig.
 - 3. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Section 220000 "Plumbing General Provisions" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance.
- D. Install shutoff valve immediately upstream of each dielectric fitting.
- E. Install domestic water piping level and plumb.
- F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- G. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install sleeves for piping penetrations of walls, ceilings, and floors.
- N. Install sleeve seals for piping penetrations of concrete walls and slabs.
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- P. Domestic cold water lines penetrating concrete slabs shall be wrapped with "Protect-O-Sleeve" vinyl flexible tube as manufactured by Robert H. Harris Co., Jones Stephen or equivalent.

- Q. PEX-a piping shall be installed per ASTM E84 requirements for plenum applications. Install all PEX-a pipe support and provide all required hangers and supporting strapping as required by manufacturer to provide a code compliant installation.
- R. Install PEX-a piping in straight runs free of kinks, provide bend supports at all pipe drops. All PEX-a piping penetrations through wall plates shall be protected or shielded as required to prevent damage to piping.
- S. Install PEX-a piping from the manifold to each fixture as a home run, not taps, tees or branches shall be permitted between the manifold and the fixture.
- T. Install PEX-a Pipe Support, fixed anchor points and hangers in compliance with the Uponor Commercial Piping Pocket Guide (2017).
- U. PEX-a shall not be installed in areas within five feet of UV light unless protected.
- V. Install piping in compliance with manufacturer's Commercial Piping Pocket Guide (2017).
- W. Install PEX-a piping at each fixture with out of the wall support bracket to secure piping and prevent excess movement when water stops or shut valves are operated.
- X. Install all PEX Manifolds centered in access panels to permit servicing.

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Braze Joints" chapter.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Joints for PEX Piping: Join according to ASTM F 1807 or ASTM F1960

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition unions.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Provide pipe hangers and support products. Install as per the following:
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.
- G. Install vinyl-coated hangers for PEX-a piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. Crosslinked Polyethylene PEX-a Pipe: Install hangers for PEX tubing in strict accordance with manufacturer's instructions.

- a. Horizontal PEX-a Piping Hangers: Install CTS hangers suitable for PEX-a piping in compliance with the Uponor Commercial Piping Pocket Guide (2017) and local codes, with the following maximum spacing:
 - b. For IPC Jurisdictions: 3 inch and below: Maximum span, 32 inches.
 - c. For UPC Jurisdictions: 1 inch and below: Maximum span, 32 inches.
 - d. For UPC Jurisdictions: 1-1/4 inch and above: Maximum span, 48 inches.
 - e. Note: The above maximum hanger spacing requirements may be extended with the use of a continuous support channel such as Uponor PEX-a Pipe Support.
 2. Horizontal PEX-a Piping with PEX-a Pipe Channel: Install hangers for PEX-a piping with horizontal support channel in accordance with local jurisdiction and manufacturer's recommendations, with the following maximum spacing:
 - a. 3/4 inch and below: Maximum span, 6 feet.
 - b. 1 inch and above: Maximum span, 8 feet.
- H. Install hangers for vertical PEX piping every 48 inches.
1. Vertical PEX-a Piping: Support PEX-a piping with maximum spacing of 5 feet.
- I. PEX-a Riser Supports: Install CTS riser clamps at the base of each floor and at the top of every other floor for domestic hot-water systems. Install mid-story guides between each floor. Install CTS riser clamps at the base of each floor and at the top of every fourth floor for domestic cold-water systems. Install mid-story guides.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

- A. Identify system components.

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

- 1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

- 2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
- b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.

- B. Domestic water piping will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

3.9 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of available chlorine. Isolate with valves and allow to stand for 24 hours (minimum time shall be 6 hours). A chlorine residual of at least 5 ppm should remain before the lines are put in use.
 - 3. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - a. Repeat procedures if biological examination shows contamination.

- b. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Underground piping up to 5'-0" from building, domestic cold water, building-service piping, NPS 4 and smaller, shall be the following:
 - 1. PVC, Schedule 40; socket fittings; and solvent-cemented joints.
- E. Aboveground domestic water piping, NPS 4 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L; copper, solder-joint fittings; and soldered joints.
- F. Under-building-slab, domestic water piping, 3" and smaller, shall be the following:
 - 1. PEX-a tube, 3" and smaller; fittings for PEX-a tube with cold expansion ASTM F1960 connection.
- G. Aboveground domestic water piping, 2" and smaller, shall be the following:
 - 1. PEX-a tube, 2" and smaller; fittings for PEX-a tube with cold expansion ASTM F1960 connection.
- H. Aboveground domestic water piping, 2-1/2" to 4", shall be the following:
 - 1. PEX-a tube, 3" and smaller; fittings for PEX-a tube with cold expansion ASTM F1960 connection.

3.12 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 3 and smaller.
 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller.
 3. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 11 16

SECTION 22 11 19 – DOMESTIC WATER PIPING 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. Vacuum breakers.
 2. Water-hammer arresters.
 3. Escutcheons
 4. Trap-seal primer valves.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 Annex G.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Standard: ASSE 1001.
 - 2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 3. Body: Bronze.
 - 4. Inlet and Outlet Connections: Threaded.
 - 5. Finish: Rough bronze.

- B. Hose-Connection Vacuum Breakers:
 - 1. Standard: ASSE 1011.
 - 2. Body: Bronze, non-removable, with manual drain.
 - 3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 4. Finish: Chrome or nickel plated.

2.4 WATER-HAMMER ARRESTERS

- A. Water-Hammer Arresters:
 - 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. AMTROL, Inc.
 - b. Precision Plumbing Products.
 - c. Sioux Chief Manufacturing Company, Inc.
 - 2. Standard: ASSE 1010 or PDI-WH 201.
 - 3. Type: Copper tube with piston.
 - 4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.
 - 5. Plumbing fixtures with quick closing valves (i.e.: Dishwashers, Ice Maker, Tub/Shower Valve, Washing Machines, etc.) install "Shock Trol", "Precision Plumbing Products", Sioux Chief "Hydra-Rester", or equal water Hammer arrester properly sized for each unit.

2.5 ESCUTCHEONS

- A. Provide escutcheons for all exposed lines passing through floors, walls, and ceilings. They shall be chrome plated brass and shall be of such flange size as to cover necessary penetrating openings.

2.6 TRAP-SEAL PRIMER DEVICE

- A. Supply-Type, Trap-Seal Primer Device:
 - 1. Standard: ASSE 1018.
 - 2. Pressure Rating: 125 psig minimum.
 - 3. Body: Bronze.
 - 4. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 5. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.

6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.
- B. Drainage-Type, Trap-Seal Primer Device:
1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
 2. Size: NPS 1-1/4 minimum.
 3. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install water-hammer arresters in water piping according to PDI-WH 201.
- B. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.
- C. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

END OF SECTION 22 11 19

SECTION 22 13 16 – SANITARY WASTE AND VENT 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. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For solvent drainage system. Include plans, elevations, sections, and details.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. Cellular-Core PVC Pipe shall not be acceptable.
- C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- D. Solvent Cement: ASTM D 2564.
 - 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 EQUIPMENT DRAIN AND RELIEF LINES

- A. These shall be Government Type "L" hard copper.
- B. Provide air gap between the indirect waste and the building drainage system in accordance with International Plumbing Code (2015 Edition).

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Section 220000 "Plumbing General Provisions."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 1 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- N. Install aboveground PVC piping according to ASTM D 2665.
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.

- Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices as per the ASHRAE Guidelines
 - 1.
 - 2. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
 - 2. NPS 3: 48 inches with 1/2-inch rod.
 - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
 - 4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
 - 5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.
- F. Install supports for vertical PVC piping every 48 inches.
- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.4 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 5. Install horizontal backwater valves with cleanout cover flush with floor in pit with pit cover flush with floor.
 6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
 7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Connect force-main piping to the following:
1. Sanitary Sewer: To exterior force main.
 2. Sewage Pump: To sewage pump discharge.
- E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- F. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
- G. Identify exposed sanitary waste and vent piping.

3.5 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water

to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.6 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.7 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Below grade & above grade, soil and waste piping NPS 6 and smaller shall be the following:
 1. Solid-wall Schedule 40, "DWV" PVC pipe, PVC socket fittings, and solvent-cemented joints.
- C. Below grade & above grade, vent piping NPS 4 and smaller shall be the following:
 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 13 16

SECTION 22 13 19 – SANITARY WASTE PIPING 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. Cleanouts.
 2. Floor drains.
 3. Roof flashing assemblies.
 4. Through-penetration firestop assemblies.
 5. Miscellaneous sanitary drainage piping specialties.
 6. Flashing materials.

1.3 DEFINITIONS

- A. PVC: Polyvinyl chloride plastic.

1.4 ACTION SUBMITTALS

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

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 FLOOR DRAINS - GENERAL

- A. All floor drains shall be constructed of cast iron and shall be complete with clamping devices as required. The following numbers are taken from the Josam Catalog: Equivalent drains as manufactured by J.R. Smith, Zurn or Wade will be acceptable. **NO OTHER MANUFACTURERS WILL BE ACCEPTED WITHOUT PRIOR APPROVAL.** All floor drains shall be provided with 2# lead flashing extending a minimum of 24" all around drain

except in certain areas where the General Contractor is providing a flashing membrane, in which case that membrane shall be flashed into the drain.

- B. All floor drains shall be installed with deep seal p-traps.

2.2 CLEANOUTS:

- A. Cleanouts other than type listed below as manufactured by J.R. Smith, Josam, Zurn and Wade, will not be acceptable.
- B. Cleanouts shall be provided where shown on plans, at each change of direction of the building drain greater than 45 degrees and at or near the foot of each vertical waste or soil stack. Location of all cleanouts shall be the same size as the piping. Every cleanout shall be installed so that the cleanout opens in the direction of the flow of the drainage line or at right angle thereto.
- C. Floor cleanouts shall be an adjustable type with anchor flange for clamp device, clamping collar and nickel bronze cover. Contractor shall install 2# lead flashing a minimum of 18" all around cleanout and flash into flange and anchor with clamping collar.
- D. Top of cleanout shall be level with top of finished floor so there is a continuous surface.
- E. Floor cleanouts shall be Zurn 1400, Wade W-6000, or J.R. Smith 4031 (NB) with adjustable scoriated secured nickel bronze top.
- F. Wall cleanouts shall be nickel bronze access frame and cover, Josam 58770, Wade W-8560-E with W-8303-1, J. R. Smith 4735 access cover.

Outside cleanouts shall be as detailed on the Plans.

2.3 ROOF FLASHING ASSEMBLIES

- A. Roof Flashing Assemblies:
 - 1. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.
 - a. Open-Top Vent Cap: Without cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

- A. Through-Penetration Firestop Assemblies:
 - 1. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
 - 2. Size: Same as connected soil, waste, or vent stack.
 - 3. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

4. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
5. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.
- C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- D. Fasteners: Metal compatible with material and substrate being fastened.
- E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- F. Solder: ASTM B 32, lead-free alloy.
- G. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- E. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

- F. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.

3.2 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
 - 2. Copper Sheets: Solder joints of copper sheets.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 42 00 – PLUMBING FIXTURES

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. Floor drains.
 2. Water closets.
 3. Flush valves.
 4. Toilet seats.
 5. Urinals.
 6. Lavatories.
 7. Sinks.
 8. Electric Water Cooler.
 9. Refrigerator water connection box.

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 for each of the plumbing fixtures.
 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flush valves to include in operation and maintenance manuals.

PART 2 - PRODUCTS

- 2.1 REFER TO PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL INFORMATION.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.
- B. Examine walls and floors for suitable conditions where plumbing fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Refer to Architectural Drawings for mounting height and exact location of all plumbing fixtures. Handicapped fixtures shall be installed to meet the latest A.D.A. requirements.

3.3 QUALITY

- A. Plumbing Contractor shall furnish and install all plumbing fixtures shown on accompanying Drawings. Refer to both Plumbing and Architectural, and provide all fixtures shown on either. Fixtures shall be complete with all necessary brass and accessories required for a complete installation, including traps, escutcheons, angle supplies, basin cocks, etc. All fixtures shall be new and must be delivered to the building properly crated in perfect condition.
- B. All brass must be of the best quality. Lightweight goods will not be accepted.
- C. All brass pipe shall be seamless brass tubing and nipples shall be extra heavy.
- D. All fittings and trim shall be chromium plated heavy brass unless otherwise specified.
- E. "P" traps on lavatories and sinks shall be cast brass with cleanouts.
- F. All exposed piping shall be chromium plated.
- G. Provide cut-off valves at each fixture in both hot and cold water piping.
- H. For the purpose of establishing type and class of fixtures required, the following plate numbers have been taken from the Manufacturer's Catalog as indicated: Other fixture manufacturer's and model numbers, with prior approval, will be acceptable, however fixtures and accessories shall meet standards and features indicated below.

- I. Contractor shall install silicon caulk around the base of a plumbing fixture or around the perimeter of a plumbing fixture where it attaches to a wall. The color of the caulk shall match the color of the plumbing fixture or shall be a color selected by the architect. Verify final color prior to installation. Caulked joint shall be properly smoothed out and shall completely seal the joint between the plumbing fixture and the surface the fixture is attached to. Unacceptable applications shall be completely removed and re-applied in accordance with directions from the architect.
- J. Water-Closet Installation:
 1. Install level and plumb according to roughing-in drawings.
 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
 3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- K. Support Installation:
 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
 2. Use carrier supports with waste-fitting assembly and seal.
 3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
 4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- L. Flushometer-Valve Installation:
 1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
 3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
 4. Install actuators in locations that are easy for people with disabilities to reach.
 5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- M. Install toilet seats on water closets.
- N. Wall Flange and Escutcheon Installation:
 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
 3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- O. Joint Sealing:
 1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
 2. Match sealant color to water-closet color.
 3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.4 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.5 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.

3.6 CLEANING AND PROTECTION

- A. Clean plumbing fixtures and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed plumbing fixtures and fittings.
- C. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 00

SECTION 23 00 00 – MECHANICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 SUMMARY

- A. The General Conditions of the Architectural Specifications, along with the supplementary conditions, special conditions, information to bidders, and any other pertinent information and documents shall apply the same as if repeated herein.



1.02 SCOPE OF WORK

- A. Furnish all labor and material necessary to provide and install the complete mechanical portion of this Contract, including HVAC systems as called for herein and on accompanying drawings. Parts of the mechanical division may be bid separately or in combination, at the Contractor's option; however, it shall be the responsibility of the General Contractor to assure himself that all items covered in the this Division have been included if he chooses to accept separate bids.
- B. This Contractor shall refer to the Architectural and Structural drawings and install equipment, piping, etc. to meet building and space requirements. No equipment shall be bid on or submitted for approval if it will not fit in the space provided.
- C. It is the intention of these Specifications that all mechanical systems shall be furnished complete with all necessary valves, controls, insulation, piping, devices, equipment, etc. necessary to provide a satisfactory installation in working order.
- D. Contractor shall visit the site and acquaint himself thoroughly with all existing facilities and conditions that would affect his portion of the work. Failure to do so shall not relieve the Contractor from the responsibility of installing his work to meet the conditions.
- E. This Contractor shall protect the entire system and all parts thereof from injury throughout the project and up to acceptance of the work. Failure to do so shall be sufficient cause for the Architect to reject any piece of equipment.

1.03 DEMOLITION

- A. The contractor shall visit the site prior to bid to determine the extent of work required to complete the project.
- B. Contractor shall coordinate demolition with owner. The Owner shall have "First Right of Refusal" regarding salvage of all equipment and materials to be removed. Locate equipment as directed by owner. All equipment and materials not salvaged by the owner shall be removed from the site and discarded at the contractor's expense.

- C. Contractor shall coordinate all work with general contractor and phase work as required by project.
- D. All equipment piping, etc. required to be removed to accommodate the modifications shall be removed.
- E. Contractor shall maintain services to existing facilities which shall remain during and after construction is complete.
- F. Contractor shall coordinate any shutdown of services with the owner. It is intended that the building will remain occupied during construction. Contractor shall schedule shut down of services with the owner in order to prevent disruption of building occupancy.
- G. Contractor shall be responsible for draining down of existing systems to complete demolition. All work shall be scheduled with the owner. Contractor shall also be responsible for refilling system and removing all air in order to return the systems to proper operating conditions.
- H. All shut down of services shall be done at night or during a time period approved by the owner. The systems shall be required to be back up and running each morning unless otherwise approved by the owner.

1.04 GROUNDS AND CHASES

- A. This Contractor shall see that all required chases, grounds, holes and accessories necessary for the installation of his work are properly built in as the work progresses; otherwise, he shall bear the cost of providing them.

1.05 CUTTING AND PATCHING

- A. Initial cutting and patching shall be the responsibility of the General Contractor, with the Mechanical Contractor being responsible for laying out and marking any and all holes required for the reception of his work. No structural beams or joists shall be cut or thimble without first receiving the approval of the Architect. After initial surfacing has been done, any further cutting, patching and painting shall be done at this Contractor's expense.

1.06 FILL AND CHARGES FOR EQUIPMENT

- A. Fill and charge with materials or chemicals all those devices or equipment as required to comply with the manufacturer's guarantee or as required for proper operation of the equipment.

1.07 MACHINERY GUARDS

- A. This Contractor shall provide v-belt guards for each v-belt drive or other hazardous drive. The guard shall enclose the drive entirely and shall have a hole for taking a tachometer reading.

- B. Provide protective guard for belts, pulleys, gears, couplings, projecting set screws, keys and other rotating parts which are located such that a person might come in close proximity. Construct protective guard around angle iron frame, securely bolted to apparatus; comply with safety requirements. Install guard to completely enclose drives and pulleys and not interfere with lubrication of equipment. Provide 2 inch minimum diameter opening in fan belt guards housing for tachometer.

1.08 REPAIRING ROADWAYS AND WALKS

- A. Where this Contractor cuts or breaks roadways or walks, in order to lay piping, he shall repair or replace these sections to meet the Architect's approval.

1.09 EXCAVATION AND BACKFILL

- A. Contractor shall perform all excavating necessary to lay the specified services. Perform excavation of every description and of whatever substance encountered to depths indicated or specified. Pile materials suitable for backfilling a sufficient distance from banks of trenches to prevent slides or cave-ins. Comply with OSHA requirements for excavation, trenching and shoring. Waste excavation materials, rubbish, etc. shall be carted away from the premises, as indicated. Remove water from trenches by pumping or other approved method, discharge at a safe distance from the excavation.
- B. Provide trenches of necessary width for proper laying of pipe and comply with latest publication of OSHA 2226 Excavating and Trenching Operations. Coordinate trench excavation with pipe installation to avoid open trenches for prolonged periods. Accurately grade bottoms of trenches to provide uniform bearing and support for each section of pipe on undisturbed soil or the required thickness of bedding material at every point along its entire length.
- C. Provide minimum 12 inches between outer surfaces and embankment or shoring, which may be used, when excavating for manholes and similar structures. Remove unstable soil that is incapable of supporting the structure in the bottom of the excavation to the depth necessary to obtain design bearing.
- D. Material to be excavated is "unclassified". No adjustment in the contract price will be made on account of the presence or absence of rock, shale, masonry, or other materials.
- E. Protect existing utility lines that are indicated or the locations of which are made known prior to excavating and trenching and that are to be retained. Protect utility lines encountered during excavating and trenching operations, from damage during excavating, trenching and backfilling; if damaged, repair lines as directed by utilities, owner and A/E. Issue notices when utility lines that are to be removed are encountered within the area of operations in ample time for the necessary measures to be taken to prevent interruption of the service.
- F. Provide trenches for utilities of a depth that will provide the following minimum depths of cover from existing grade or from indicated finished grades, or depths of cover in accordance with the manufacturer's recommendations, whichever is lower:

1. 3-Foot Minimum Cover: Chilled Water lines, Heating Hot Water Lines, Condenser Water Lines.
- G. Underground piping shall have a 6" bed of sand below the piping and backfilled with sand to 6" above the top of piping. Select fill may be used above the sand layer.
- H. Backfill trenches after piping, fittings and joints have been tested and approved. Backfill trenches with sand to provide 6 inches of sand below piping and 12 inches of sand cover above piping.
- I. Backfill remainder of trenches with satisfactory material consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones not over 1-1/2 inches in size. Deposit backfill material in 9 inch maximum layers, loose depth as indicated or as specified. Take care not to damage utility lines.
- J. Deposit the remainder of backfill materials in the trench in 1 foot maximum layers and compact by mechanical means. Refer to architectural for minimum density for compaction (Minimum 85 percent of maximum soil density as determined by ASTM D 698). Re-open trenches and excavation pits improperly backfilled or where settlement occurs to the depth required to obtain the specified compaction, the refill and compact with the surface restored to the required grade and compaction.
- K. Backfill utility line trench with backfill material, in 6 inch layers, where trenches cross streets, driveways, building slabs, or other pavement. Moisten each layer and compact to 95 percent of the maximum soil density as determined by ASTM D 698. Accomplish backfilling in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value so that paving of the area can proceed immediately after backfilling is complete.

1.10 WELDING

- A. Weld piping and above grade steel tanks in accordance with qualified procedures using performance qualified welders and welding operators. Qualified procedures and welders in accordance with ASME Section IX. Welding procedures qualified by others and welders and welding operators qualified by another employer may be accepted as permitted by ANSI B31.1. Notify the A/E 24 hours in advance of tests, and perform the tests at the work site if practicable. Furnish A/E with a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. Apply welders or welding operators assigned symbols near each weld they make as permanent record.

1.11 NOISE AND VIBRATION

- A. Provide the plumbing system and its associated components, items, piping, and equipment free of objectionable vibration or noise. Statically and dynamically balance rotating equipment and mount or fasten so that no vibration is transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional compensation.

1.12 PAINTING

- A. All painting shall be by the General Contractor or Painting Sub-Contractor. All pipe, pipe covering, equipment, supports, hangers, etc. exposed in the building or equipment room shall be painted. This Contractor shall prepare the surface of the material to receive the first coat of paint.

1.13 CLEANING AND ADJUSTING

- A. Upon completion of his work, the Contractor shall clean and adjust all equipment, controls, valves, etc.; clean all piping, ductwork, etc.; and leave the entire installation in good working order.

1.14 OPERATING AND MAINTENANCE INSTRUCTIONS

- A. Provide the Owner with three (3) copies of printed instructions indicating various pieces of equipment by name and model number, complete with parts lists, maintenance and repair instructions and test and balance report.
- B. COPIES OF SHOP DRAWINGS WILL NOT BE ACCEPTABLE AS OPERATION AND MAINTENANCE INSTRUCTIONS BUT MUST BE INCLUDED IN SUBMITTAL PACKAGE.
- C. This information shall be bound in plastic hardbound notebooks with the job name permanently embossed on the cover. Rigid board dividers with labeled tabs shall be provided for different pieces of equipment. Submit manuals to the Architect for approval.
- D. In addition to the operation and maintenance brochure, the Contractor shall provide a separate brochure which shall include registered warranty certificates on all equipment, especially any pieces of equipment which carry warranties exceeding one (1) year.
- E. The operation and maintenance brochure shall be furnished with a detailed list of all equipment furnished to the project, including the serial number and all pertinent nameplate data such as voltage, amperage draw, recommended fuse size, rpm, etc. The Contractor shall include this data on each piece of equipment furnished under this contract.

1.15 GUARANTEE

- A. The Contractor shall guarantee all materials, equipment and workmanship for a period of one (1) year from the date of final acceptance of the project. This guarantee shall include furnishing of all labor and material necessary to make any repairs, adjustments or replacement of any equipment, parts, etc. necessary to restore the project to first class condition. This guarantee shall exclude only the changing or cleaning of filters. Warranties exceeding one (1) year are hereinafter specified with individual pieces of equipment.

1.16 LOCAL CONDITIONS

- A. The location and elevation of all utility services is based on available surveys and utility maps and are reasonably accurate; however, these shall serve as a general guide only, and the Contractor shall visit the site and verify the location and elevation of all services to his satisfaction in order to determine the amount of work required for the execution of the Contract.
- B. The Contractor shall contact the various utility companies, determine the extent of their requirements and he shall include in his bid all lawful fees and payments required by these companies for complete connection and services to the building, including meters, connection charges, street patching, extensions from meters to main, etc.
- C. In case major changes are required, this fact, together with the reasons therefor, shall be submitted to the Architect, in writing, not less than seven (7) days before the date of bidding. Failure to comply with this requirement will make the Contractor liable for any changes, additions and expenses necessary for the successful completion of the project.

1.17 PERMITS, INSPECTIONS AND TESTS

- A. All permits, fees, etc. for the installation, inspections, plan review, service connections locations, and/or construction of the work which are required by any authority and/or agencies having jurisdiction, shall be obtained and paid for by the Contractor. This shall be verified during the bidding process.
- B. The Contractor shall make all tests required by the Architect, Engineer or other governing authorities at no additional cost to the Owner.
- C. The Contractor shall notify the Architect and local governing authorities before any tests are made, and the tests are not to be drawn off a line covered or insulated until examined and approved by the authorities. In event defects are found, these shall be corrected and the work shall be retested.
- D. Prior to requesting final inspection by the Architect, the Contractor shall have a complete coordination and adjustment meeting of all of his sub-contractors directly responsible for the operation of any portion of the system. At the time of this meeting, each and every sequence of operation shall be checked to assure proper operation. Notify the Architect in writing ten (10) days prior to this meeting, instructing him of the time, date and whom you are requesting to be present.
- E. This project shall not be accepted until the above provisions are met to the satisfaction of the Architect.

1.18 CODES AND STANDARDS

- A. The entire mechanical work shall comply with the rules and regulations of the City, Parish, County and State in which this project is being constructed, including the State Fire Marshal and the State Board of Health. All modifications required by these authorities shall be made

without additional charge to the Owners. The Mechanical Contractor shall report these changes to the Architect and secure his approval before work is started.

- B. In addition to the codes heretofore mentioned, all mechanical work and equipment shall conform to the applicable portions of the following specifications, codes and/or regulations:
1. American Society of Heating, Refrigeration and
 2. Air Conditioning Engineers (ASHRAE)
 3. National Electrical Code (NEC)
 4. National Fire Protection Association (NFPA)
 5. American Society of Mechanical Engineers (ASME)
 6. American Gas Association (AGA)
 7. International Building Code (IBC)
 8. International Mechanical Code (IMC)
 9. International Plumbing Code (IPC)
 10. International Fuel Gas Code (IFGC)
 11. Underwriters Laboratories (UL)
 12. Life Safety Code (NFPA 101)
 13. State Sanitary Code
 14. Louisiana State Uniform Construction Code Council (LSUCCC)
 15. Facility Guidelines Institute "Guidelines for Design and Construction of Hospitals and Outpatient Facilities" (2014 Edition)
- C. All materials, equipment and accessories installed under this Contract shall conform to all rules, codes, etc. as recommended by National Associations governing the manufacturer, rating and testing of such materials, equipment and accessories. All materials shall be new and of the best quality and first class in every respect. Whenever directed by the Architect, the Contractor shall submit a sample for approval before proceeding.
- D. Where laws or local regulations provide that certain accessories such as gauges, thermometers, relief valves and parts be installed on equipment, it shall be understood that such equipment be furnished complete with the necessary accessories, whether or not called for in these Specifications.
- E. All unfired pressure vessels shall be built in accordance with the A.S.M.E. Code and so stamped. Furnish shop certificates for each vessel.

1.19 REVIEW OF MATERIALS

- A. Whenever manufacturers or trade names are mentioned in these Plans or Specifications, the words "or approved equivalent" shall be assumed to follow whether or not so stated. Manufacturers or trade names are used to establish a standard of quality only, and should not be construed to infer a preference. Equivalent products which meet the Architect's approval will be accepted; however, these products must be submitted to the Architect a minimum of seven (7) days prior to the Bid Date.
- B. Submission shall include the manufacturer's name, model number, rating table and construction features.

- C. Upon receipt and checking of this submittal, the Architect will issue an addendum listing items which are approved as equivalent to those specified. THE CONTRACTOR SHALL BASE HIS BID SOLELY ON THOSE ITEMS SPECIFIED OR INCLUDED IN THE "PRIOR APPROVAL ADDENDUM", AS NO OTHER ITEM WILL BE ACCEPTABLE.
- D. Prior approval of a particular piece of equipment does not mean automatic final acceptance and will not relieve the Contractor of the responsibility of assuring himself that this equipment is in complete accord with the Plans and Specifications and that it will fit into the space provided. Shop drawings must be submitted on all items of equipment for approval as hereinafter specified.
- E. Before proceeding with work and/or within thirty (30) days after the award of the General Contract for this work, the Mechanical Contractor shall furnish to the Architect complete shop and working drawings of such apparatus, equipment, controls, insulation, etc. to be provided in this project. These drawings shall give dimensions, weights, mounting data, performance curves and other pertinent information.
- F. The Architect's approval of shop drawings shall not relieve the Contractor from the responsibility of incorrectly figured dimensions or any other errors which may be contained in these drawings. Any omission from the shop drawings or specifications, even though approved by the Architect, shall not relieve the Contractor from furnishing and erecting same.
- G. If contractor submits hard copies, Six (6) sets of shop drawings shall be submitted to the Architect for approval. These submittals shall be supplied as part of this Contractor's contract.
- H. This information shall be bound in plastic hardbound notebooks with the job name on the cover. Rigid board dividers with labeled tabs shall be provided for different pieces of materials and equipment. Submit shop drawings to the Architect for approval. Faxed copies shall not be acceptable. We prefer electronic submissions sent via E-Mail.
- I. Required shop drawing submittals shall include but are not limited to the following:
1. VRF Air Conditioning Equipment.
 2. Grilles, registers, diffusers and louvers.
 3. Ductwork and duct sealer.
 4. Duct insulation and accessories.
 5. Controls/Building Automation System.
 6. Exhaust fans.
 7. Unit heaters.
 8. Relief and intake hoods.
 9. Fire dampers
 10. Smoke dampers.
 11. Manual Dampers, Motorized Dampers and Control Dampers.
 12. Actuators.
 13. Test and Balancing Agency (including forms).

1.20 COORDINATION DRAWINGS

- A. Submit three (3) black line prints of all mechanical room layouts showing locations of all equipment, piping, etc. to insure all will fit in space provided. Submit drawings at 1/4" scale. Layouts shall include equipment submitted on project to scale on plans.
- B. Submit coordination drawings with the respective equipment shop drawings.

1.21 MINOR DEVIATIONS

- A. Plans and detail sketches are submitted to limit, explain and define conditions, specified requirements, pipe sizes and manner of erecting work. Structural or other conditions may require certain modifications from the manner of installation shown, and such deviations are permissible and shall be made as required. However, specified sizes and requirements necessary for satisfactory operation shall remain unchanged. It may be necessary to shift ducts or pipes, or to change the shape of ducts, and these changes shall be made as required. All such changes shall be referred to the Architect and Engineer for approval before proceeding. Extra charges shall not be allowed for these changes. The contractor shall obtain a full set of plans and specifications for the coordination of his work prior to bidding this project. Items which are unclear to the bidding contractor shall be brought to the Architect and Engineers attention prior to bidding the project. An interpretation shall be clarified by the Architect and/or the Engineer prior to bidding.
- B. The Contractor shall realize that the drawings could delve into every step, sequence or operation necessary for the completion of the project, without drawing on the Contractor's experience or ingenuity. However, only typical details are shown on the Plans. In cases where the Contractor is not certain about the method of installation of his work, he shall ask for details. Lack of details will not be an excuse for improper installation.
- C. In general, the drawings are diagrammatic and the Contractor shall install his work in a manner so that interferences between the various trades are avoided. In cases where interferences do occur, the Architect is to state which item was first installed.

1.22 AS-BUILT RECORD DRAWINGS

- A. The Contractor shall obtain at his cost, two sets of blackline prints of the original bid documents by the Architect. One set shall be kept on the site with all information as referenced below, and shall update same as the work progresses. The other set will be utilized to record all field changes to a permanent record copy for the Owner.
- B. If the Contractor elects to vary from the Contract Documents and secures prior approval from the Architect for any phase of the work, he shall record in a neat and readable manner, ALL such variances on the blackline print in red. The original blackline prints shall be returned to the Architect for documentation.

- C. All deviations from sizes, locations, and from all other features of the installations shown in the Contract Documents shall be recorded.
- D. In addition, it shall be possible using these drawings to correctly and easily locate, identify and establish sizes of all piping, directions and the like, as well as other features of the work which will be concealed underground and/or in the finished building.
- E. Locations of underground work shall be established by dimensions to columns, lines or walls, locating all turns, etc., and by properly referenced centerline or invert elevations and rates of fall.
- F. For work concealed in the building, sufficient information shall be given so it can be located with reasonable accuracy and ease. In some cases this may be by dimension. In others, it may be sufficient to illustrate the work on the drawings in relation to the spaces in the building near which it was actually installed. The Architect's/Engineer's decision in this matter will be final.
- G. The following requirements apply to all "As-Built" drawings:
 - 1. They shall be maintained at the Contractor's expense.
 - 2. All such drawings shall be done carefully and neatly, and in a form approved by the Architect/Engineer.
 - 3. Additional drawings shall be provided as necessary for clarifications.
 - 4. These drawings shall be kept up-to-date during the entire course of the work and shall be available upon request for examination by the Architect/Engineer; and when necessary, to establish clearances for other parts of the work.
 - 5. "As-built" drawings shall be returned to the Architect upon completion of the work and are subject to approval of the Architect/Engineer.

PART 2 PRODUCTS

2.01 HVAC SYSTEM PRODUCTS

- A. Refer to individual Division 23 sections for mechanical products, controls, fans, pipe, tube and fitting materials and joining methods.

PART 3 EXECUTION

3.01 MANUFACTURER'S DIRECTION

- A. The contractor shall install and operate all equipment and material in accordance with the manufacturer's installation and operating instructions. The manufacturer's instructions of installation and operation shall become part of the Contract Documents and shall supplement the Drawings and Specifications.

3.02 EQUIPMENT LABELS

- A. Provide equipment labels for HVAC Equipment. Labels shall have permanent laminated construction secured to equipment.

- B. Provide laminated plate for each VRF unit. For Ducted units above ceiling and refrigerant controllers (BC/BS)- Attach plate to ceiling grid to indicate location above ceiling. Plate shall be white with black letters. For ceiling recessed units – Attached plate within the filter compartment. Tag shall not interfere with the filter installation. Coordinate color selection with owner.

3.03 PIPE LABELS

- A. Provide pipe markers and directional arrows on all piping in mechanical equipment rooms, or which is exposed in building, and on both sides of all valves located above ceiling. Markers shall be as manufactured by W.H. Bradley Co., Marking Services Inc. or the equivalent. All letters shall be color-coded and sized as recommended by OSHA. Samples of the type of letters to be used shall be submitted with shop drawings. Piping shall be color-coded.
- B. Pipe markers with arrows shall indicate lines content and shall be located 20 feet on center and at each change of direction of line. Identification bands shall be color coded to match pipe markers and shall be provided 10 feet on center. Pipe identification markers shall be taped at each end and shall be taped around the entire circumference of pipe.

3.04 ACCESS DOORS:

- A. Provide access doors in walls, floors and ceilings to permit access to equipment and piping requiring service or adjustment.
 - 1. Valves.
 - 2. Manual balancing dampers and automatic control dampers.
 - 3. Air terminal units and VRF indoor units.
 - 4. Duct mounted filters and coils.
 - 5. Drainage cleanouts.
 - 6. Kitchen Hood exhaust ductwork in accordance with NFPA requirements.
 - 7. Equipment shutoff protection devices such as disconnects, motor rated switches, etc.
 - 8. Other mechanical equipment indicated in schedules or specifications which are requiring maintenance, adjustment or operation.
- B. Provide hinged access doors and frames as follows:
 - 1. Drywall Construction:
 - a. Provide with concealed spring hinges and flush screwdriver operated cam locks in sufficient number of the size of the panel.

- b. Provide prime paintable surface (not galvanized).
- c. Product: Milcor “Style M” (Karp DSC-214M).
- 2. Visible Masonry and Ceramic Tile:
 - a. Milcor “Style M” (Karp DSC-214M).
- 3. Cement Plaster:
 - a. Milcor “Style K” (Karp DSC-214 PL).
- 4. Acoustical Plaster:
 - a. Reinforced panel as required to prevent sagging. Provide continuous steel piano type hinge for the length of the panel, and sufficient number for the size of the panel. Provide factory prime paint surface (not galvanized).
 - b. Product: Milcor “Style AP” (Karp 214 PL).
- 5. Acoustical Tile:
 - a. Milcor “Style AT” (Larsen L-CPA).
- C. Provide continuous concealed hinges and cam locks.
- D. Provide UL listed 1-1/2 hour label “B” access doors with automatic self-closing latching mechanism where required.
- E. Provide removable ceiling access tile section immediately adjacent to each mechanical or electrical device located in the ceiling plenum above removable tile ceiling.
- F. Coordinate approval of type, color and location of access doors & frames with Architect.

3.05 CLEANING AND SERVICE

- A. Upon Completion of this work, the contractor shall clean and adjust equipment, controls, valves, etc.;
- B. Inspect, clean and service air filters and strainers immediately prior to final acceptance of project.
- C. Provide complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced condition, check the charge and modify it for proper operation as required.

- D. Place mechanical systems in complete working order. Clean equipment and piping materials thoroughly returning to “as new” condition prior to request for substantial completion.
- E. Remove excess materials and debris from mechanical rooms and drain pans. Broom clean areas. Thoroughly clean ductwork inside and outside before air devices (diffusers, grilles, etc.) are installed.

3.06 TEMPORARY HEATING AND AIR CONDITIONING DURING CONSTRUCTION PHASE

- A. Permanent building air conditioning equipment or systems are not designed to control building temperature and humidity levels during construction of the building. The building’s HVAC system is not designed nor is it well suited for the proper drying of building/construction materials, and should not be used for such purposes.
- B. At all times, during construction phases, provide temporary ventilation both for comfort and protection of workers, for proper drying of wet work, and for proper curing of installed materials. Follow material manufacturer’s published instructions with regard to installation of building materials.
- C. Provide temporary heat both for the comfort and protection of workers and as necessary to ensure suitable working conditions for construction operations of construction trades, and also as necessary for storage of products and materials. Refer to material manufacturer’s literature for environmental operational temperature and humidity requirements.
- D. Provide temporary heat by use of self-contained, vented portable heating units, employing tanked gas or other approved heat source.
- E. Use only heating apparatus and fuels labeled or listed by a “National Recognized Testing Laboratory” recognized by OSHA. Keep equipment and surroundings in clean, safe conditions.
- F. Use flame resistant tarpaulins other material for temporary enclosures of space.
- G. Provide temporary humidity control by the use of small incremental de-humidifiers, packaged desiccant type de-humidifiers, and/or packaged DX type air conditioners.
- H. Do not permit space temperatures to reach or fall to a level which will cause damage to work. Coordinate the temperature and humidity requirements with the manufacturer of the finishes being provided.
- I. Replace interior or exterior surfaces damaged by the use of temporary heaters with new materials or refinish at no additional expense to the owner.
- J. As soon as practical after permanent heating, ventilation, and air conditioning systems are in place and operable, the contractor at his option, may provide heat from the permanent building heating system, until such time that the building is complete. It is recommended that the building’s permanent heating and air conditioning systems not be utilized to maintain temperature and humidity conditions within the building during the construction phase. Small space heaters and portable de-humidifiers are suggested as sources of temperature and

- humidity control. It is the intent that the permanent HVAC systems should not be used to condition or control humidity during construction.
- K. The use of permanent HVAC systems will require that the systems be complete and fully controllable by the Building Automation System (BAS) including the ability to remotely alarm proper maintenance personnel in the event of any and all system failure(s) or inability to maintain setpoint temperatures and humidity levels. Should the contractor elect to utilize the building's permanent HVAC system, the contractor shall bring the HVAC systems and ductwork back to an original unused condition or state by thoroughly cleaning and/or repairing both equipment and ductwork including repair and refinishing scrapes, tears, scratches and dents, cleaning ductwork, cleaning AHU coils, etc.
- L. All dust, dirt, fungal growth, and debris in duct work shall be cleaned.
- M. All disposable or wearable parts such as belts, filters, etc., shall be replaced without option or cause.
- N. Contractor's Use of Permanent HVAC Systems:
1. Heating System:
 - a. Should the contractor (at his option and at his own risk), utilize the building's permanent heating systems provided under this contract to provide space heating prior to project completion date subject to the restraints stated herein.
 - b. The fuel for such space heating and for required tests of heating equipment shall be provided by contractor.
 - c. The start up of equipment for use by the contractor shall not commence any warranty period.
 - d. The heating system shall be operated only by qualified personnel, and shall be operated with all auxiliaries, safeties, and in accordance with manufacturer's instructions and good operating practice.
 - e. If at any time the Owner's Representative determines that the equipment is being improperly operated or maintained, contractor will be directed to disconnect its use.
 - f. Heating systems shall be operated and controlled to prevent temperature in any room or space in any building from exceeding 90 deg. F.
 - g. Temperature controls shall be functional to the extent that the operating temperatures of equipment, ductwork piping, etc., shall not either fall or be elevated above or below normal operating limits. The contractor shall demonstrate to the owner or his representative the ability of the system to be controlled, including limit alarms installed and the ability to monitor the systems off-site.

- h. Systems shall not be operated unattended such as on holidays, weekends, nights, etc, nor shall personnel unfamiliar with the operation of the HVAC Systems be employed to “monitor or attend to” the systems such as security personnel, or janitorial staff. The heating system, when in operation, shall be continuously monitored by the mechanical contractor’s approved personnel.
 - i. Systems when activated, may be placed into operation without diffusers and registers in place, but filters capable of filtering gypsum dust or other associated construction dust and debris shall be provided both in air handling equipment and at return air grille locations. Filter all return air entering duct work, to prevent return air ductwork from accumulating dust or otherwise becoming dirty.
 - j. Prior to final acceptance of the work, the contractor shall place heating systems and related equipment in a condition equal to new in that contractor shall clean all ductwork, coils, equipment, etc.
 - k. All disposable or wearable parts such as belts, filters, etc., shall be replaced without option or cause.
2. Preliminary Heating Test, Adjusting and Balancing Report:
- a. Provide a TAB report at the time the heating system(s) start-up which shall indicate the following conditions:
 - 1) Air pressure drop across the unit filters
 - 2) Air pressure drop across the unit’s cooling coil(s)
 - 3) Air pressure drop across the unit’s heating coil(s)
 - 4) Total static pressure produced by the unit
 - 5) Discharge air static pressure
 - 6) Fan RPM
 - 7) Suction air pressure
 - 8) Provide a unit pressure graph
 - 9) Discharge air temperature (each air moving device)
 - 10) Return air temperature (each air moving device)
3. Air Conditioning System:
- a. Should the contractor (at his option and at his own risk), utilize the building’s permanent air conditioning systems provided under this contract to provide space cooling and de-humidification prior to the project completion date. As such, any damages, loss of performance, wear, and other detrimental effects caused by the operational performance characteristics of the A/C system such as condensation, sweating of grilles, registers, diffusers, ducts, equipment, walls, floors, ceilings, and other conditions which may cause damage to building components or which cause mold, mildew, etc., shall be the total responsibility of the contractor.

- b. The fuel, electricity or other energy required for space cooling and for any subsequent operation or testing shall be provided by the Contractor.
- c. The cooling system(s) shall be operated only by fully qualified personnel and shall be operated with all safety auxiliaries, and in accordance with manufacturer's instructions and good operating practice.
- d. Start-up of equipment for use by the Contractor shall not commence any warranty period.
- e. If at any time the Owner's Representative determines that the equipment is being improperly operated or maintained, the contractor will be directed to discontinue and disconnect its use and the contractor will be required to provide portable units to maintain space temperatures.
- f. Temporary cooling and/or de-humidification systems shall be operated and controlled to prevent temperature and humidity in any room or space in any portion of the building from falling below 75 deg. F or above 65% relative humidity.
- g. Temperature controls shall be functional to the extent that the operating temperatures of equipment, ductwork, piping, etc., shall not fall below the normal stated "design" operating limits. The contractor shall demonstrate to the owner or his representative the ability of the system to be controlled, including limit alarms installed and the ability to monitor the systems off-site.
- h. Insulation systems for all piping, ductwork, etc., shall be completely installed prior to use of the permanent systems.
- i. Systems shall not be operated unattended such as on holidays, weekends, nights, etc., nor shall personnel unfamiliar with the operation of the HVAC Systems be employed to "monitor or attend to" the systems such as security personnel, or janitorial staff. The air conditioning system when in operation, shall be continuously monitored by the mechanical contractor's approved personnel.
- j. Systems when activated, may be placed into operation without diffusers and registers in place, but filters capable of filtering gypsum dust or other associated construction dust and debris shall be provided both in air handling equipment and at return air grille locations. Filter all return air entering duct work, to prevent return air duct work from accumulating dust or otherwise becoming dirty.
- k. Contractor shall, prior to final acceptance of the work, place cooling systems and related equipment in a condition equal to new in that contractor shall clean all ductwork, coils, equipment, etc.

1. All disposable or wearable parts such as belts, filters, etc., shall be replaced without option or cause.

4. Preliminary Air Conditioning Test, Adjusting and Balancing Report:
 - a. Provide a TAB report at the time the heating system(s) start-up which shall indicate the following conditions:
 - 1) Air pressure drop across the unit filters
 - 2) Air pressure drop across the unit's cooling coil(s)
 - 3) Air pressure drop across the unit's heating coil(s)
 - 4) Total static pressure produced by the unit
 - 5) Discharge air static pressure
 - 6) Fan RPM
 - 7) Suction air pressure
 - 8) Provide a unit pressure graph
 - 9) Discharge air temperature (each air moving device)
 - 10) Return air temperature (each air moving device)

END OF SECTION 23 00 00

SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.

- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque.
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor: Random-wound, squirrel cage.
- F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F.
- I. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
- J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.

- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All materials and equipment shall be installed in accordance with Manufacturer's recommended installation methods for obtaining conformance with the Contract Documents.
- B. Alignment of all motors, factory coupled or mounted, and all motors field coupled and mounted, shall be rechecked after all connections have been made and after 48 hours of operation in designed service.
- C. Verify the voltage characteristics of each motor prior to ordering.
- D. Verify the correct wire connections and rotation of equipment by "bumping" motor after wiring.
- E. Confirm voltage imbalance on 3-phase motors is less than 2%.

3.2 APPLICATION: Except as specifically indicated, motors shall be selected as follows:

- A. Phase:
 - 1. Less than 1.0 HP: Single-Phase.
 - 2. 1 HP and Larger: Three-phase.
- B. Single Phase Starting:
 - 1. 1/8 HP and Less: Split phase or permanent split capacitor.
 - 2. Greater than 1/8 HP: Capacitor start.
- C. Enclosure:
 - 1. Totally enclosed fan-cooled (TEFC) for all motors located outside above roof, in wet areas, in mechanical rooms, or elsewhere as indicated.
 - 2. Open drip-proof (ODP) for motors located elsewhere, in a clean, dry environment.

END OF SECTION 23 05 13

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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. Metal pipe hangers and supports.
 2. Trapeze pipe hangers.
 3. Metal framing systems.
 4. Thermal-hanger shield inserts.
 5. Fastener systems.
 6. Pipe stands.
 7. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of the Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1.
 - 2. Manufacturers:
 - a. Cooper B-Line, Inc.; a division of Cooper Industries.
 - b. Flex-Strut Inc.
 - c. Thomas & Betts Corporation, A Member of the ABB Group.
 - d. Unistrut; an Atkore International company.
 - e. Wesanco, Inc.
 - 3. Standard: MFMA-4.
 - 4. Channels: Continuous slotted steel channel with inturned lips.
 - 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

7. Metallic Coating: Electroplated zinc.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.
- B. Roof Sleepers for VRF outdoor condensing units: Pate Model ES-2 or equal, equipment rail supports, 18 ga. Galvanized steel, unitized construction with integral base plate, continuous welded corner seams, pressure treated wood nailer, counterflashing with screws. Height of support shall be a minimum of 16 inches. Coordinate layout of supports with the equipment manufacturer's representative and equipment point loading requirements. Coordinate flashing and exterior insulation with the roofing installer and Architect.

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use carbon-steel pipe hangers and supports metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- E. Use thermal-hanger shield inserts for insulated piping and tubing.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.

7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.

4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.

3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 23 05 29

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Equipment Labels.
 - 2. Chilled Water Piping Labels (Exterior)

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
 - 1. Manufacturer shall be one of the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. Emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services, Inc.
 - j. Seton Identification Products.
 - 2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 3. Letter Color: White.

4. Background Color: Black.
 5. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 6. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 7. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 8. Fasteners: Stainless-steel rivets.
 9. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment Drawing designation or unique equipment number, drawing numbers where equipment is indicated (plans, details, and schedules).
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

- A. Labels for Chilled Water Piping (Exterior):
1. Manufacturer shall be one of the following:
 - a. Brady Corporation.
 - b. Brimar Industries, Inc.
 - c. Carlton Industries, LP.
 - d. Champion America.
 - e. Craftmark Pipe Markers.
 - f. Emedco.
 - g. Kolbi Pipe Marker Co.
 - h. LEM Products Inc.
 - i. Marking Services, Inc.
 - j. Seton Identification Products.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulated.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

END OF SECTION 23 05 53

SECTION 23 05 93 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

- A. The Contractor shall obtain the services of an independent Test and Balance (TAB) Company which specializes in the testing and balancing of heating, ventilating and air conditioning (HVAC) systems to test, adjust and balance all HVAC systems in the building(s).
- B. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. The testing, adjusting and balancing agency shall act as a reporting agency; that is, list and report each piece of equipment as to identification number, manufacturer, model number, serial number, proper location, specified performance, and report actual performance of all equipment as found during testing. The report is intended to be used during the life of the building as a ready reference indicating original conditions, equipment components, etc.
- C. Representatives of the Test and Balance Company shall visit the job site during installation of the HVAC equipment, piping and ductwork as required.
- D. Upon completion of the HVAC system installation, the Test and Balance Company shall perform all required testing and balancing with the full cooperation of the Contractor and his Sub-contractors. The Contractor shall make changes and/or adjustments to the HVAC system components that are required by the Test and Balance Company to accomplish proper balancing. The TAB agency shall not supply or install any materials or balancing devices such as pulleys, drives, belts, etc. All of this work is by the Contractor and shall be performed at no additional cost to the Owner.
- E. The test and balance report complete with a summary page listing all deficiencies shall be submitted to the Architect for review. If the Architect agrees with the report, he shall sign it and return it to the Contractor. The test and balance report must be complete and must be accepted by the Architect prior to acceptance of the project. Any outstanding test and balance items shall be placed on the punch list and a monetary value shall be assigned to them.
- F. After all deficiencies have been corrected the Architect shall sign the testing and balancing report, and the Test and Balance Company shall supply four (4) copies of the final and complete report to the Contractor for inclusion in the Operation and Maintenance Manuals.

- G. The Test and Balance Company shall obtain a copy of all HVAC related shop drawings from the contractor. The contractor shall provide a set of approved shop drawings to the TAB contractor within 30 days from receiving approved shop drawings.
- H. The items requiring testing, adjusting, and balancing include (but are not restricted to) the following:
 - 1. Air Systems:
 - a. Supply Fan AHU
 - b. Relief Fans
 - c. Exhaust Fans
 - d. Zone Branch and main ducts
 - e. Diffusers, Registers, Grilles and Dampers
 - f. Coils (Air Temperatures)
 - g. Vibration Isolators
 - 2. Duct leakage tests.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.
- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.4 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.
- B. Sample report forms.

1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA[®] "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine operating safety interlocks and controls on HVAC equipment.

- K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. After testing and balancing, install test ports and duct access doors.
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish.
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified.

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.
 - 3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.

4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.

3.6 PROCEDURES FOR MOTORS

- A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.

- B. Measure entering- and leaving-air temperatures.
- C. Record fan and motor operating data.

3.8 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.
- D. Ductwork that initially fails these tests shall be replaced, modified, resealed, etc. as required to meet the leakage requirement and then re-test to ensure compliance.

3.9 TOLERANCES

- A. Set HVAC system airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Equipment with Fans: Plus or minus 10 percent.
 - 2. Exhaust Fans: Plus 10 percent.
 - 3. Outside Airflow: Plus 10 percent.
 - 4. Air Outlets and Inlets: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.10 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Include a certification sheet at the front of the report binder, signed and sealed by the certified testing and balancing engineer.
 - 2. Include a list of instruments used for procedures, along with proof of calibration.
 - 3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
 - 1. Fan curves.
 - 2. Manufacturers test data.
 - 3. Field test reports prepared by system and equipment installers.
 - 4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
 - 1. Title page.
 - 2. Name and address of the TAB specialist.
 - 3. Project name.
 - 4. Project location.
 - 5. Architect name and address.

6. Engineer's name and address.
 7. Contractor's name and address.
 8. Report date.
 9. Signature of TAB supervisor who certifies the report.
 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
 11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
 12. Nomenclature sheets for each item of equipment.
 13. Notes to explain why certain final data in the body of reports vary from indicated values.
 14. Test conditions for fans performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Fan drive settings including settings and percentage of maximum pitch diameter.
 - e. Settings for supply-air, static-pressure controller.
 - f. Other system operating conditions that affect performance.
- D. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
 - a. Unit identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and unit size.
 - e. Manufacturer's serial number.
 - f. Unit arrangement and class.
 - g. Discharge arrangement.
 - h. Sheave make, size in inches, and bore.
 - i. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - j. Number, make, and size of belts.
 - k. Number, type, and size of filters.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave and amount of adjustments in inches.
 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Filter static-pressure differential in inches wg.
 - f. Preheat-coil static-pressure differential in inches wg.
 - g. Cooling-coil static-pressure differential in inches wg.
 - h. Heating-coil static-pressure differential in inches wg.

- i. Outdoor airflow in cfm.
 - j. Return airflow in cfm.
 - k. Outdoor-air damper position.
 - l. Return-air damper position.
 - m. Vortex damper position.
- E. Fan Test Reports: For supply, return, and exhaust fans, include the following:
- 1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 - 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.
 - f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- F. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
- 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft.
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
 - k. Barometric pressure in psig.
- G. Instrument Calibration Reports:
- 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.

- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

- A. The TAB specialist shall test and balance engineer shall conduct the inspection in the presence of Architect.
- B. Architect may randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
- C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 - 2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
 - 3. If the second verification also fails, the design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13 – DUCT 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 insulating the following duct services:
 - 1. Indoor, concealed supply, return, exhaust and outdoor air.
 - 2. Tops of supply air diffusers, grilles and plenum boxes.
 - 3. Indoor, kitchen hood and kitchen hood exhaust air.
 - 4. Mechanical Room Walls

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance, thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields as specified.
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Fire Rated Insulation:
 - 1. Manufacturer shall be one of the following:
 - a. 3M FireMaster Fast Wrap 615+.
 - b. Thermal Ceramics FireMaster.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Manufacturer shall be one of the following:
 - a. Aeroflex, USA, Inc.
 - b. Armacell LLC.
- H. Fiber-Glass Blanket Insulation: Fiber-Glass bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Manufacturer shall be one of the following:
 - a. Certainteed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Manson Insulation Inc.
 - e. Owens Corning.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Manufacturer shall be one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Foster Brand.
- C. Fiber-Glass Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Manufacturer shall be one of the following:
 - a. Childers Brand.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand.
 - d. Mon-Eco Industries, Inc.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
 - 1. Manufacturer:
 - a. Foster Brand.
 - b. Knauf Insulation.
 - c. Vimasco Corporation.
 - d. Childers.
 - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
 - 5. Color: White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.5 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.

4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
 - d. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - e. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - f. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

2.8 WALL LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers shall be as follows:
 - a. Certainteed
 - b. Owens Corning
 - c. Johns Manville
 - d. Knauf

2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF FIBER-GLASS INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
 - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 WALL LINER

- A. Apply on all mechanical room walls from floor to ceiling / deck.
 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners or cut and fit to ensure butted-edge overlapping.
 5. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
 5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.9 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies.

3.10 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

- a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply air.
 - 2. Indoor, concealed return air.
 - 3. Indoor, concealed exhaust air.
 - 4. Indoor, concealed outdoor air.
 - 5. Indoor, return air plenum boxes.
 - 6. Indoor, tops of ceiling diffusers and grilles.
 - 7. Indoor, kitchen hood and kitchen hood exhaust air.
 - 8. Mechanical Room Walls
- B. Items Not Insulated:
 - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 2. Factory-insulated flexible ducts.

3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.13 DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- B. Concealed, round and flat-oval, return-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- C. Concealed, round and flat-oval, outdoor-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- E. Concealed, rectangular, supply-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- F. Concealed, rectangular, return-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- G. Concealed, rectangular, outdoor-air duct insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- I. Return air plenum boxes installation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- J. Tops of supply air diffusers and grilles insulation shall be the following:
 1. Mineral-Fiber Blanket: 2.125 inches thick and 0.75-lb/cu. ft. nominal density.
 2. Minimum installed R-value shall be R-6.0.
- K. Indoor, kitchen hood and kitchen hood exhaust air shall be the following:
 1. Fire rated blanket: (Minimum) Two layers of 1-1/2" thick fire wrap insulation.

2. Insulate the grease duct with a high temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2 hour fire rating. Thickness of insulation and the quantity of layers shall be as required to achieve 2-hour fire rating. The fire rated blanket system shall be installed in accordance with the manufacturer's recommendations to meet the latest NFPA requirements for 0 inch clearance to combustibles.
- L. Mechanical Room Wall Liner
1. Wall Liner: Fibrous glass, Type I, [**1 inch**] thick.

END OF SECTION 23 07 13

SECTION 23 07 19 – HVAC PIPING 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 insulating the following HVAC piping systems:
 - 1. Condensate drain piping, indoors and outdoors.
 - 2. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Manufacturer shall be one of the following:
 - a. Armacell AP.
 - b. Aeroflex USA.
 - c. K-Flex USA.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
 1. Manufacturers shall be one of the following:
 - a. Childers Brand.
 - b. Eagle Bridges – Marathon Industries.
 - c. Foster Brand.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.

2.4 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. Metal Jacket:
 1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Finish and thickness are indicated in field-applied jacket schedules.
 - b. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - c. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.

- 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
2. At contractor's option, in lieu of 0.016 aluminum jacket, the contractor may use Venture Clad 1577CW multi-layered laminate coated, acrylic pressure sensitive adhesive jacket system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 1. Verify that systems to be insulated have been tested and are free of defects.
 2. Verify that surfaces to be insulated are clean and dry.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.

- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- L. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- M. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
 - 1. Pipe: Install insulation continuously through floor penetrations.

2. Seal penetrations through fire-rated assemblies.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 1. Install pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
 2. Underground piping.
 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.

- B. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 3/4 inch thick.

3.10 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Flexible Elastomeric: 1 inches thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Refrigerant Piping, Concealed:
 - 1. None.
- D. Refrigerant Piping, Exposed:
 - 1. Aluminum, Smooth: 0.016 inch thick.

3.12 OUTDOOR, FIELD-APPLIED MASTIC SCHEDULE

- A. Install two layers of mastic over insulation material.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Condensate Piping, Concealed:
 - 1. None.
- D. Condensate Piping, Exposed:
 - 1. Vapor-Barrier Mastic: Solvent based.

END OF SECTION 23 07 19

SECTION 23 21 14 – HVAC CONDENSATE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
 - 1. Condensate-drain piping.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Copper Tube.
 - 2. Plastic pipe and fittings with solvent cement.
- B. Delegated-Design Submittal:
 - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
 - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
 - 4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
 - 1. Condensate-Drain Piping: 140 deg F.

2.2 COPPER TUBE AND FITTINGS

- A. DWV Copper Tubing: ASTM B 306, Type DWV.

2.3 PLASTIC PIPE AND FITTINGS

- A. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.
 - 1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.

2.4 JOINING MATERIALS

- A. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- D. Solvent Cements for Joining Plastic Piping:
 - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
 - a. PVC solvent cement shall have a VOC content of 510 g/L or less.
 - b. Adhesive primer shall have a VOC content of 550 g/L or less.
 - c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health (formerly, the California Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.5 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings:
 - 1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.
- B. Plastic-to-Metal Transition Unions:
 - 1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.
- B. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- M. Install shutoff valve immediately upstream of each dielectric fitting.

- N. Comply with requirements specified for identifying piping.

3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements specified for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- C. Install hangers for copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- D. Plastic Piping Hanger Spacing: Space hangers shall be according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
- E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. PVC Pressure Piping: Join ASTM D 1785 schedule number, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule number PVC pipe and socket fittings according to ASTM D 2855.
 - 3. PVC Nonpressure Piping: Join according to ASTM D 2855.
- F. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

END OF SECTION 23 21 14

SECTION 23 23 00 – REFRIGERANT 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. Section Includes:
 - 1. Refrigerant pipes and fittings.
 - 2. Refrigerant piping valves and specialties.
 - 3. Refrigerants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of valve, refrigerant pipe and refrigerant piping specialty.
- B. Shop Drawings:
 - 1. Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes; flow capacities; pipe lengths, branch controller locations, valve arrangements and locations; slopes of horizontal runs; oil traps; double risers; wall and floor penetrations; and equipment connection details.
 - 2. Show piping size and piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.
 - 3. Show interface and spatial relationships between piping and equipment.
 - 4. Calculate refrigerant volume based on actual pipe layout for each VRF system.
 - 5. Shop Drawing Scale: 1/8 inch equals 1 foot.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

- A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:
 - 1. Suction Lines for Air-Conditioning Applications: 300 psig.
 - 2. Suction Lines for Heat-Pump Applications: 535 psig.
 - 3. Hot-Gas and Liquid Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or ASTM B 280, Type ACR.
- B. Contractor may use pre-insulated refrigerant line sets provided and/or approved by the VRF equipment manufacturer.

2.3 REFRIGERANTS

- A. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

- A. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR Type L, annealed- or drawn-temper tubing and copper fittings with brazed joints.
- B. Safety-Relief-Valve Discharge Piping: Copper, Type L, annealed- or drawn-temper tubing and wrought-copper fittings with soldered joints.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.

- C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping adjacent to machines to allow service and maintenance.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified if valves or equipment requiring maintenance is concealed behind finished surfaces.
- L. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

3.3 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.
- D. Soldered Joints: Construct joints according to ASTM B 828 or CDA[®] "Copper Tube Handbook."
- E. Brazed Joints: Construct joints according to AWS[®] "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements for pipe hangers and supports specified.
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:
 - 1. NPS 1/2: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 2. NPS 5/8: Maximum span, 60 inches; minimum rod, 1/4 inch.
 - 3. NPS 1: Maximum span, 72 inches; minimum rod, 1/4 inch.
 - 4. NPS 1-1/4: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 5. NPS 1-1/2: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 6. NPS 2: Maximum span, 96 inches; minimum rod, 3/8 inch.
 - 7. NPS 2-1/2: Maximum span, 108 inches; minimum rod, 3/8 inch.
 - 8. NPS 3: Maximum span, 10 feet; minimum rod, 3/8 inch.
 - 9. NPS 4: Maximum span, 12 feet; minimum rod, 1/2 inch.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Comply with ASME B31.5, Chapter VI.
 - 2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
 - 3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- B. Prepare test and inspection reports.

3.6 SYSTEM CHARGING

- A. Charge system using the following procedures:
 - 1. Install core in filter dryers after leak test but before evacuation.

2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

END OF SECTION 23 23 00

SECTION 23 31 13 – METAL DUCTS

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. Single-wall rectangular ducts and fittings.
 - 2. Single-wall round ducts and fittings.
 - 3. Sheet metal materials.
 - 4. Sealants and gaskets.
 - 5. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Adhesives.
 - 2. Sealants and gaskets.

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA® "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - 2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

- D. Tees and Laterals: Select types and fabricate according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA® "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Duct Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Galvanized sheet metal for rectangular and round ductwork shall have a minimum gauge of 26.

2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Manufacturers shall be as follows:
 - a. Certaineed
 - b. Owens Corning
 - c. Johns Manville
 - d. Knauf
 - 2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 - 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
 - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

- B. Two-Part Tape Sealing System:
1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. VOC: Maximum 75 g/L (less water).
 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Solvent-Based Joint and Seam Sealant:
1. Application Method: Brush on.
 2. Base: Synthetic rubber resin.
 3. Solvent: Toluene and heptane.
 4. Solids Content: Minimum 60 percent.
 5. Shore A Hardness: Minimum 60.
 6. Water resistant.
 7. Mold and mildew resistant.
 8. Service: Indoor or outdoor.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
 2. Type: S.
 3. Grade: NS.
 4. Class: 25.
 5. Use: O.
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

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

2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
 - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
 - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.

- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements as specified for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article."
- B. If ducts are not listed in the "Duct Schedule" Article then seal unlisted ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Ducts:

- a. Pressure Class: Positive 2-inch wg.
- b. Minimum SMACNA Seal Class: A.
- c. SMACNA Leakage Class for Rectangular: 6.
- d. SMACNA Leakage Class for Round and Flat Oval: 3.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 1. Where practical, install concrete inserts before placing concrete.
 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA[®] "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA[®] "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
 - a. Ducts with a Pressure Class Higher Than **3-Inch wg**:
 - 1) Test representative duct sections totaling no less than **25 percent** of total installed duct area for each designated pressure class.
 - b. Exhaust Ducts with a Pressure Class of **2-Inch wg or Higher**:
 - 1) Test representative duct sections totaling no less than **50 percent** of total installed duct area for each designated pressure class.
 - c. Outdoor Air Ducts with a Pressure Class of **2-Inch wg or Higher**:
 - 1) Test representative duct sections totaling no less than **50 percent** of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days[□]advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
 - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean [**new**] duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

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

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

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

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

- A. Air Balance: Comply with requirements as specified.

3.10 DUCT SCHEDULE

- A. Supply Ducts:
 - 1. Ducts Connected to Constant-Volume Units, VRF Outside Air Units and RTUs:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- B. Return Ducts:
 - 1. Ducts Connected to Constant-Volume Units, VRF Outside Air Units and RTUs:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Constant-Volume Units, VRF Outside Air Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- E. Duct Liner:
 - 1. Supply Air Ducts: Fibrous glass, Type I, [1 inch] thick.
 - 2. Return Air Ducts: Fibrous glass, Type I, [1 inch] thick.
 - 3. Supply Diffuser Plenums: Fibrous glass, Type I, [1 inch] thick.
 - 4. Return- Plenums: Fibrous glass, Type I, [1 inch] thick.
 - 5. Transfer Ducts: Fibrous glass, Type I, [1 inch] thick.

END OF SECTION 23 31 13

SECTION 23 33 00 – AIR DUCT 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. Manual volume dampers.
 2. Motorized dampers.
 3. Spin Collars.
 4. Fire dampers.
 5. Ceiling Radiation Dampers.
 6. Smoke Dampers.
 7. Combination Fire and Smoke Dampers.
 8. Flange connectors.
 9. Turning vanes.
 10. Duct-mounted access doors.
 11. Flexible connectors.
 12. Flexible ducts.
 13. Duct accessory hardware.
 14. Outside Air Intake Hoods, roof mounted.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA  "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS


- A. Low-Leakage, Steel, Manual Volume Dampers:
 - 1. Manufacturers:
 - a. Greenheck.
 - b. Dace Mfg.
 - c. Nailor Industries Inc.
 - d. Pottorff.
 - e. Ruskin Company.
 - 2. Comply with AMCA 500-D testing for damper rating.
 - 3. Low-leakage rating, with linkage outside airstream, and bearing AMCA[®] Certified Ratings Seal for both air performance and air leakage.
 - 4. Suitable for horizontal or vertical applications.
 - 5. Frames:
 - a. Hat Channel shaped.
 - b. 0.031-inch- thick, galvanized sheet steel.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 6. Blades:
 - a. Multiple blade.
 - b. Opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.031 inch thick.
 - 7. Blade Axles: Galvanized steel.
 - 8. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 - 9. Blade Seals: Neoprene.
 - 10. Jamb Seals: Stainless Steel.
 - 11. Tie Bars and Brackets: Galvanized steel.
 - 12. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- B. Jackshaft:
 - 1. Size: 0.5-inch diameter.

2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 MOTORIZED DAMPERS

- A. Low-leakage rating, with linkage outside airstream, and bearing AMCA  Certified Ratings Seal for both air performance and air leakage.

B. Manufacturers:

1. Greenheck.
2. Flex-Tek Group.
3. Nailor Industries Inc.
4. Pottorff.
5. Ruskin Company.

- C. For Round Duct Type, Mechanical Contractor shall furnish and install motorized dampers at outdoor intakes as indicated on mechanical and architectural drawings. Damper shall be parallel blade motorized type equivalent to Ruskin CDRS25, Greenheck Model VCDR-53, Arrow Series 250SRD or equal. Motorized dampers shall be operated by 120/1/60 electric actuator as indicated on plans. Provide Interlock with respective air handling unit. Interlock with respective air handling unit shall be low voltage. Damper shall be complete with outboard support bearing, blade and jamb seals. Dampers shall be low - leakage type.

- D. For Rectangular Duct Type, Mechanical Contractor shall furnish and install motorized dampers at outdoor intakes as indicated on mechanical and architectural drawings. Damper shall be parallel blade motorized type equivalent to Ruskin CD36/PB, Arrow Series 1770, Greenheck Model VCD-23 or equal. Motorized dampers shall be operated by 120/1/60 electric actuator as indicated on plans. Provide Interlock with respective air handling unit. Interlock with respective air handling unit shall be low voltage. Damper shall be complete with outboard support bearing, blade and jamb seals. Dampers shall be low - leakage type.

E. Frames:

1. Hat shaped.
2. 0.064-inch- thick, galvanized sheet steel.
3. Mitered and welded corners.

F. Blades:

1. Multiple blade with maximum blade width of 6 inches.
2. Opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch thick single skin.
5. Blade Edging: Closed-cell neoprene.

6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- G. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
 1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- H. Bearings:
 1. Molded synthetic.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.5 SPIN COLLARS

- A. All round take-offs to round branch duct shall be made with factory fabricated spin-type collar fittings with balancing damper and constructed of minimum 26 ga galvanized steel. The damper shall have a raised 2" handle with a high quality locking quadrant. A 3/8" continuous rod with "U" bolts connects the damper to the rod. Nylon end bearing are required where the rod penetrates the spin collar barrel. These spin-collars shall be as manufactured by Flexmaster Model FLD-B03, Dace #26ga MSD-C03 or approved equal.

2.6 HIGH EFFICIENCY TAPS

- A. All round connections to rectangular main ducts located upstream of VAV terminals shall be made with factory fabricated 45 degree low loss entry "shoe" tap fittings constructed of minimum 24 ga galvanized steel. These low loss fittings shall be as manufactured by Flexmaster Model STO, Dace #24ga STO or approved equal.

2.7 FIRE DAMPERS

- A. The contractor shall furnish and install UL555 rated 1-1/2 hour fire dampers at the locations indicated on the drawings in new ducts and sound attenuators. The contractor shall provide dampers with sleeves and angle frames necessary to comply with the manufacturer's UL installation requirements. Dampers for vertical or horizontal air flow shall be provided as required.
- B. Manufacturers:
 1. Greenheck.
 2. Flex-Tek Group.
 3. Nailor Industries Inc.
 4. Pottorff.
 5. Ruskin Company.
- C. Fire damper shall be 100% free area and installed in wall and floor openings utilizing steel sleeves, angles, other materials and practice required to provide an installation equivalent to that utilized by the manufacturer when dampers are tested by UL555. Installation shall be in accordance with the damper manufacturer's instructions.

- D. Fire damper for rectangular ductwork and transfer openings shall be Ruskin type DIBD-B, Greenheck Model DFD-150-B (Basis of Design).
- E. Fire dampers for round ductwork shall be Ruskin Model DIBD-CR, Greenheck DFD-150-CR (Basis of Design).
- F. All fire dampers shall be installed per N.F.P.A. and U.L. requirements. Install U.L. approved sealant around the perimeter of the angle iron support at the sleeve and the wall in accordance with U. L. recommendations.
- G. All fire dampers shall meet the latest Class 1 leakage requirements.

2.8 CEILING RADIATION DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Nailor Industries Inc.
 - 2. Pottorff.
 - 3. Ruskin Company.
- B. General Requirements:
 - 1. Labeled according to UL 555C by an NRTL.
 - 2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."
- C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.
- D. Blades: Galvanized sheet steel with refractory insulation.
- E. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.
- F. Fire Rating: 1 hours.

2.9 SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff.
 - 3. Ruskin Company.
- C. <http://www.specagent.com/Lookup?ulid=3450> General Requirements: Label according to UL 555S by an NRTL.
- D. Smoke Detector: Integral, factory wired for single-point connection.
- E. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded corners.

- F. Blades: Roll-formed, horizontal, interlocking, **0.063-inch- (1.6-mm)** thick, galvanized sheet steel.
- G. Leakage: Class I.
- H. Rated pressure and velocity to exceed design airflow conditions.
- I. Mounting Sleeve: Factory-installed, **0.05-inch- (1.3-mm-)** thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- J. Damper Motors: two-position action.
- K. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of **150 in. x lbf (17 N x m)** and breakaway torque rating of **150 in. x lbf (17 N x m)**.
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at **minus 40 deg F (minus 40 deg C)**.
 - 6. Nonspring-Return Motors: For dampers larger than **25 sq. ft. (2.3 sq. m)**, size motor for running torque rating of **150 in. x lbf (17 N x m)** and breakaway torque rating of **300 in. x lbf (34 N x m)**.
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.
- L. Accessories:
 - 1. Auxiliary switches for signaling fan control or position indication.
 - 2. Test and reset switches, damper mounted.

2.10 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Pottorff.
 - 3. Ruskin Company.
- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- D. Fire Rating: 1-1/2 and 3 hours.
- E. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel, with welded interlocking, gusseted corners.
- F. Heat-Responsive Device: Resettable, 165 deg F (74 deg C) rated, fire-closure device.
- G. Heat-Responsive Device: Electric resettable device and switch package, factory installed, rated.
- H. Smoke Detector: Integral, factory wired for single-point connection.
- I. Blades: Roll-formed, horizontal, interlocking, 0.034-inch- (0.85-mm-) thick, galvanized sheet steel.
- J. Leakage: Class I.
- K. Rated pressure and velocity to exceed design airflow conditions.
- L. Mounting Sleeve: Factory-installed, 0.05-inch- (1.3-mm-) thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- M. Master control panel for use in dynamic smoke-management systems.
- N. Damper Motors: two-position action.
- O. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
 - 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 - 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 150 in. x lbf (17 N x m).
 - 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F (minus 40 deg C).
 - 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft. (2.3 sq. m), size motor for running torque rating of 150 in. x lbf (17 N x m) and breakaway torque rating of 300 in. x lbf (34 N x m).
 - 7. Electrical Connection: 115 V, single phase, 60 Hz.

P. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Test and reset switches, damper mounted.

2.11 TURNING VANES

- A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- C. General Requirements: Comply with SMACNA® "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.12 DUCT-MOUNTED ACCESS DOORS

- A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA® "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
 1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
 2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
 3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches with outside and inside handles.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.13 DUCT ACCESS PANEL ASSEMBLIES

- A. Labeled according to UL 1978 by an NRTL.
- B. Panel and Frame: Minimum thickness 0.0528-inch carbon steel.

- C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.
- D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.
- E. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.14 FLEXIBLE CONNECTORS

- A. Materials: Flame-retardant or noncombustible fabrics.
- B. Coatings and Adhesives: Comply with UL 181, Class 1.
- C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
 - 1. Minimum Weight: 26 oz./sq. yd.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.
- E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..
 - 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
 - 3. Service Temperature: Minus 50 to plus 250 deg F.
- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.
 - 1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 - 2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 - 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.

2.15 FLEXIBLE DUCTS

- A. Manufacturers:
 - 1. Thermaflex Model M-KE
 - 2. Flexmaster 1M

- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
 - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1. (R6)
- C. Flexible Duct Connectors:
 - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
 - 2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.16 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.17 OUTSIDE AIR INTAKE HOODS (ROOF MOUNTED)

- A. Furnish and install intake hoods where indicated on Plans. Intake hood shall be Shipman Model SRV-1, Greenheck Model FGI/FGR, Acme Skymaster or prior approved equivalent.
- B. Each hood shall be of all extruded aluminum construction. Base and throat shall have continuous welded mitered corners. Hood and extrude structural members shall utilize stainless steel fasteners. Each hood shall have a full 360 degree perimeter opening for air flow. Hoods shall be designed to withstand 100 mph winds. Hoods shall be furnished with hinges to swing open for access to dampers. Each hood shall be furnished with mesh insect screens and factory fabricated roof curb.
- C. Intake hoods shall have a 2-to-1 ratio of hood perimeter opening to throat area to provide an inlet velocity at the hood opening not to exceed 650 feet per minute.
- D. Hood shall be provided with a minimum of a 14" high roof curb.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA® "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. Upstream from duct filters.
 - 2. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
 - 3. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 4. At each change in direction and at maximum 50-foot spacing.
 - 5. Control devices requiring inspection.
 - 6. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body plus Ladder Access: 25 by 17 inches.
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

- N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.
- Q. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Operate dampers to verify full range of movement.
 - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 - 3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 - 4. Inspect turning vanes for proper and secure installation.
 - 5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 23 33 00

SECTION 23 34 23 - HVAC POWER VENTILATORS

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. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Operating Limits: Classify according to AMCA 99.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

- C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers:
 - 1. Cook.
 - 2. Greenheck.
 - 3. ACME
 - 4. Pen-Barry
 - 5. Twin City
- B. All exhaust fans shall be equipped with bird screen, automatic back-draft dampers, solid state speed controller (direct drive) and integral disconnect switch unless noted otherwise. Fan motors shall be of the 40 deg C ambient temperature rise type and shall be suitable for continuous duty operation.
- C. Direct drive fans shall be complete with solid state speed control switch mounted on unit for balancing. Interlock with remote on/off switch.
- D. Housing: Steel, lined with acoustical insulation.
- E. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- F. Grille: Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- G. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

2.2 CEILING MOUNTED FANS

- A. Manufacturers:
 - 1. Cook.
 - 2. Greenheck.

3. ACME
 4. Pen-Barry
 5. Twin City
- B. All exhaust fans shall be equipped with bird screen, automatic back-draft dampers, solid state speed controller (direct drive) and integral disconnect switch unless noted otherwise. Fan motors shall be of the 40 deg C ambient temperature rise type and shall be suitable for continuous duty operation.
- C. Direct drive fans shall be complete with solid state speed control switch mounted on unit for balancing. Interlock with remote on/off switch.
- D. Housing: Steel, lined with acoustical insulation.
- E. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- F. Grille: White ceiling mounted metal grille. The grille shall be removable to provide service access to fan, motor, etc.
- G. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
- B. Enclosure Type: Totally enclosed, fan cooled.

2.4 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Install units with clearances for service and maintenance.
- C. Label units according to requirements specified.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment.

3.3 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Replace fan and motor pulleys as required to achieve design airflow.
- D. Lubricate bearings.

END OF SECTION 23 34 23

SECTION 23 35 33 – LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS

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. Listed grease ducts.
- 2. Access doors.

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 for listed grease ducts.

- B. Shop Drawings: For listed grease ducts.

- 1. Include plans, elevations, sections, and attachment details.
- 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:

- 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
- 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in listed grease ducts and field-fabricated grease ducts.

PART 2 - PRODUCTS

2.1 LISTED GREASE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AMPCO Stacks.
 2. McGill AirFlow LLC.
 3. Metal-Fab, Inc.
 4. Ventilation Direct.
- B. Description: Factory-fabricated, -listed, and -labeled, double-wall ducts tested according to UL 1978 and rated for **500 deg F (260 deg C)** continuously, or **2000 deg F (1093 deg C)** for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a [**1-inch (25-mm)**] annular space filled with high-temperature, ceramic-fiber insulation.
1. Inner Shell: ASTM A 666, Type 304 stainless steel.
 2. Outer Jacket: Stainless steel where concealed. Stainless steel where exposed.
- D. Gaskets and Flanges: Ensure that gaskets and sealing materials are rated at **1500 deg F (816 deg C)** minimum.
- E. Hood Connectors: Constructed from same material as grease duct with internal or external continuously welded or brazed joints.
- F. Accessories: Tees, elbows, increasers, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters, and drain fittings.
- G. Grease Duct Supports: Construct duct bracing and supports from non-combustible material.
1. Design bracing and supports to carry static and seismic loads within stress limitations of the International Building Code.
 2. Ensure that bolts, screws, rivets and other mechanical fasteners do not penetrate duct walls.
- H. Comply with ASTM E 2336.
- I. Factory Tests: Test and inspect fire resistance of grease duct system according to ASTM E 2336.

2.2 ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M.
 2. Acudor Products, Inc.
 3. Ductmate Industries, Inc.
 4. Sachwin Products, Inc.
- B. Description: Factory-fabricated, -listed, and -labeled, double-wall maintenance access doors tested according to UL 1978 and rated for **500 deg F (260 deg C)** continuously, or **2000 deg F (1093 deg C)** for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.
1. Construction: [**0.0625 inch (1.6 mm)**] ASTM A 666, Type 304 stainless-steel inner shell and stainless-steel outer cover with two handles.
 2. Fasteners: Stainless-steel bolts and wing nuts.
 - a. Ensure that bolts do not penetrate interior of duct space.
 3. Maintenance Access Door Dimensions: **7 x 7 inches (178 x 178 mm)**.
 4. Personnel Access Door Dimensions: **24 x 24 inches (610 x 610 mm)**.
 5. Door Label: Mark door with uppercase lettering as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions 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. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Comply with requirements in Section 077200 "Roof Accessories."
- B. Coordinate connections to kitchen exhaust hoods with requirements in Section 233813 "Commercial-Kitchen Hoods."
- C. Coordinate connections to exhaust fans with requirements in Section 233416 "Centrifugal HVAC Fans."

- D. Coordinate firestopping where grease ducts penetrate fire separations with requirements in Section 078413 "Penetration Firestopping."
- E. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211 and UL 2221, whichever is most stringent.
- F. Install airtight personnel and maintenance access doors where indicated.
- G. Seal between sections of grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- H. Connections: Make grease duct connections according to the International Mechanical Code.
 - 1. Grease duct to exhaust fan connections: Connect grease ducts to inlet side of fan using flanges, gaskets, and bolts.
 - 2. Grease duct to hood connections:
 - a. Make grease duct to hood joints connections using internal or external continuously welded or brazed joints.
 - b. Make watertight grease duct to hood joints connections using flanges, gaskets, and bolts.
- I. Support ducts at intervals recommended by manufacturer to support weight of ducts and accessories, without applying loading on kitchen hoods.
 - 1. Securely attach supports and bracing to structure.
- J. Grease Duct Enclosures: Comply with requirements of the International Building Code and ASTM E 2336.
- K. Coordinate fire-rated enclosure construction with Section 092116.23 "Gypsum Board Shaft Wall Assemblies."
- L. Repair damage to adjacent materials caused by listed kitchen ventilation system exhaust ducts installation.

3.3 FIELD QUALITY CONTROL

- A. Perform air leakage test before concealment of any portion of the grease duct system.

END OF SECTION 23 35 33

SECTION 23 37 13 – DIFFUSERS, REGISTERS, GRILLES, AND 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. Rectangular and square ceiling diffusers.
 - 2. Louvered face diffuser.
 - 3. Fixed face registers and grilles.
- B. Related Sections:
 - 1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Rectangular and Square Ceiling Diffusers:
 - 1. Manufacturers:
 - a. Titus.
 - b. Price Industries.
 - c. Nailor Industries.
 - d. Metalaire, Inc.
 - 2. Devices shall be specifically designed for variable-air-volume flows.
 - 3. Material: Aluminum.
 - 4. Finish: Baked enamel, white.
 - 5. Face Size: 24 by 24 inches.
 - 6. Face Style: Three cone.
 - 7. Mounting: T-bar.

8. Pattern: Fixed.

B. Louver Face Diffuser:

1. Material: Aluminum.
2. Finish: Baked enamel, white.
3. Face Size: See schedule on Drawings..
4. Mounting: Surface with beveled frame.
5. Pattern: Four-way core style.
6. Dampers: Radial opposed blade.
7. Accessories:
 - a. Square to round neck adaptor.

2.2 REGISTERS AND GRILLES

A. Fixed Face Register:

1. Manufacturers:
 - a. Titus.
 - b. Price Industries.
 - c. Nailor Industries.
 - d. Metalaire, Inc.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Core Construction: Integral.
5. Frame: 1 inch wide.
6. Mounting: Lay in.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13

SECTION 23 70 10 – VARIABLE REFRIGERANT FLOW EQUIPMENT

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 complete VRF HVAC system(s) including, but not limited to, delegated design and the following components to make a complete operating system(s) according to requirements indicated:

1. Indoor, concealed, ceiling-mounted units for ducting.
2. Indoor, recessed, ceiling-mounted units.
3. Indoor, dedicated 100% outside air ventilation units.
4. Outdoor, air-source, heat recovery units.
5. Outdoor, air-source 100% outside air - heat recovery units.
6. Heat recovery control units.
7. System controls.
8. System refrigerant and oil.
9. System condensate drain piping.
10. System refrigerant piping.
11. Metal hangers and supports.
12. Metal framing systems.
13. Fastener systems.
14. Pipe stands.
15. Miscellaneous support materials.
16. Piping and tubing insulation.
17. System control cable and raceways.

1.3 DEFINITIONS

- A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.
- B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.
- C. Heat Recovery System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

- D. HRCU: Heat Recovery Control Unit. HRCUs are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones. "Heat Recovery Control Unit" is the term used by ASHRAE for what different manufacturers term as branch circuit controller, branch selector box, changeover box, flow selector unit, mode change unit, and other such terms.
- E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- F. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
- G. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One liquid line and refrigerant vapor line connect HRCUs to associated indoor units.
- H. Two-Pipe System Design: One refrigerant vapor line and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system HRCUs. One refrigerant liquid line and refrigerant vapor line connect HRCUs to associated indoor units. HRCUs used in two pipe systems act as an intermediate heat exchanger and include diverting valves and gas/liquid separators to move high and low pressure refrigerant between indoor units.
- I. VRF: Variable refrigerant flow.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

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 for indoor and outdoor units and for HRCUs.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
 - 4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
 - 5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit and HRCU control.
 - 6. Include description of control software features.
 - 7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.

8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittals:

1. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
2. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
3. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, ductwork, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Service access panels.

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
 - a. Retain copies of Installer certificates on-site and make available on request.
 2. For VRF HVAC system manufacturer.
 3. For VRF HVAC system provider.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: Where tests are required, for each product, for tests performed by a qualified testing agency.
- E. Source quality-control reports.
- F. Field quality-control reports.
- G. Sample Warranties: For manufacturer's warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.
- B. Training videos conducted during owner training of equipment.
- C. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Filters:
 - a. Provide two sets for each unit type and unique size of washable filters. One set will be installed in the unit at the end of the project and the other spare set will be used to facilitate washing and drying of filters.
 2. Controllers for Indoor Units: two for each unique controller type installed.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of 10 years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. VRF temperature control system shall be open protocol. The system shall not require a manufacture representative to allow changes to system.
6. Having full-time in-house employees for the following:
 - a. Product research and development.
 - b. Product and application engineering.
 - c. Product manufacturing, testing, and quality control.
 - d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
 - e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

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

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.

- a. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
 - b. Demonstrated past experience on five projects of similar complexity, scope, and value.
5. Installers shall have staffing resources of competent, trained, and experienced full-time employees that are assigned to execute work according to schedule.
- D. Mockups: Build mockups to set quality standards for materials and execution.
1. Build mockups to show a finished installation for each of the following applications:
 - a. For each different indoor unit type with exposed surfaces viewable by occupants.
 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.
- E. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in a clean and dry place.
- B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.
- C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.
- D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.
 1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
 2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remove coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
- E. Replace installed products damaged during construction.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:

- a. Structural failures.
 - b. Faulty operation.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period:
- a. For Compressor: (10) Ten year(s) from date of Substantial Completion.
 - b. For Parts, Including Controls: (10) Ten year(s) from date of Substantial Completion.
 - c. For Labor: (1) One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufactures: Subject to compliance with requirements, provide products by one of the following:
- 1. Mitsubishi Electric City Multi (Basis of Design).**
 - 2. Daikin.**
- B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:
1. Indoor and outdoor units, including accessories.
 2. Controls and software.
 3. HRCUs.
 4. Refrigerant isolation valves.
 5. Specialty refrigerant pipe fittings.

2.2 SYSTEM DESCRIPTION

- A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, HRCUs, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.
1. Two-pipe or hybrid-two/three-pipe system design.
 2. System(s) operation, air-conditioning, heat pump, or heat recovery as indicated on Drawings.
 3. Each system with one refrigerant circuit shared by all indoor units connected to system.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.
- D. ASHRAE Compliance:
 - 1. ASHRAE 15: For safety code for mechanical refrigeration.
 - 2. ASHRAE 62.1: For indoor air quality.
 - 3. ASHRAE 135: For control network protocol with remote communication.
 - 4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.
- E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional specialist to design complete and operational VRF HVAC system(s) complying with requirements indicated.
 - 1. Provide system refrigerant calculations.
 - a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
 - b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.
 - 2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
 - 3. System Refrigerant Piping and Tubing:
 - a. Arrangement: Arrange piping to interconnect indoor units, HRCUs, and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
 - b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
 - c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.
 - 4. System Controls:
 - a. Network arrangement.
 - b. Network interface with other building systems.
 - c. Product selection.
 - d. Sizing.
- B. Service Access:
 - 1. Provide and document service access requirements.

2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
 3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
 4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
 5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
 6. Comply with OSHA regulations.
- C. System Design and Installation Requirements:
1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
 2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.
- D. System Adaptability to Future Changes: Arrange and size system refrigerant piping to accommodate future changes to system without having to resize and replace existing refrigerant piping.
1. Future changes to system(s) indicated on Drawings.
 2. Each branch circuit shall accommodate addition of two indoor unit(s) with unit capacity equal to largest indoor unit connected to the branch circuit.
 3. Each branch circuit shall accommodate deletion of one indoor unit(s) with unit capacity equal to average indoor unit connected to the branch circuit.
- E. Isolation of Equipment: Provide isolation valves to isolate each HRCU, indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.
- F. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:
1. Not less than 50 percent.
 2. Not more than 130 percent.
 3. Range acceptable to manufacturer.
- G. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.
- H. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.
- I. Outdoor Conditions:
1. Suitable for outdoor ambient conditions encountered.

- a. Design equipment and supports to withstand wind loads of governing code.
 - b. Design equipment and supports to withstand snow and ice loads of governing code.
 - c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.
- J. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.
1. Indoor: See Drawings.
 2. Outdoor: Within ordinance of governing authorities.
- K. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.
- L. Capacities and Characteristics: As indicated on Drawings.
- 2.4 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING
- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
- B. Cabinet:
1. Material: Galvanized steel.
 2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
 3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
 4. Mounting: Manufacturer-designed provisions for field installation.
 5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. DX Coil Assembly:
1. Coil Casing: Aluminum, galvanized, or stainless steel.
 2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
 3. Coil Tubes: Copper, of diameter and thickness required by performance.
 4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
 5. Unit Internal Tubing: Copper tubing with brazed joints.
 6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
 7. Field Piping Connections: Manufacturer's standard.
 8. Factory Charge: Dehydrated air or nitrogen.
 9. Testing: Factory pressure tested and verified to be without leaks.
- D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
 2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
 3. Field Piping Connection: Non-ferrous material.
- E. Fan and Motor Assembly:
1. Fan(s):
 - a. Direct-drive arrangement.
 - b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
 - c. Fabricated from non-ferrous components or ferrous components with corrosion-resistant finish.
 - d. Wheels statically and dynamically balanced.
 2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
 3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
 5. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Filter Assembly:
1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
 2. Efficiency: ASHRAE 52.2, MERV 8.
 3. Media:
 - a. Washable: Manufacturer's standard filter with antimicrobial treatment.
- G. Unit Accessories:
1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control sized to allow sequence of operation indicated on Drawings.
 2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
- H. Unit Controls:
1. Enclosure: Metal, suitable for indoor locations.
 2. Factory-Installed Controller: Configurable digital control.
 3. Factory-Installed Sensors:
 - a. Unit inlet air temperature.
 - b. Coil entering refrigerant temperature.
 - c. Coil leaving refrigerant temperature.
 4. Field-Customizable I/O Capability:
 - a. Analog Inputs: Four for use in customizable control strategies.

- b. Digital Inputs: Four for use in customizable control strategies.
 - c. Digital Outputs: Four for use in customizable control strategies.
5. Features and Functions:
- a. Self-diagnostics.
 - b. Time delay.
 - c. Auto-restart.
 - d. External static pressure control.
 - e. Auto operation mode.
 - f. Manual operation mode.
 - g. Filter service notification.
 - h. Power consumption display.
 - i. Drain assembly high water level safety shutdown and notification.
 - j. Run test switch.
6. Communication: Network communication with other indoor and outdoor units.
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- I. Unit Electrical:
- 1. Enclosure: Metal, suitable for indoor locations.
 - 2. Field Connection: Single point connection to power unit and integral controls.
 - 3. Disconnecting Means: Factory-mounted circuit breaker or switch.
 - 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 - 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- 2.5 INDOOR, RECESSED, CEILING-MOUNTED UNITS
- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
- B. Cabinet:
- 1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
 - 2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
 - 3. Mounting: Manufacturer-designed provisions for field installation.
 - 4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
 2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
 3. Coil Tubes: Copper, of diameter and thickness required by performance.
 4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
 5. Internal Tubing: Copper tubing with brazed joints.
 6. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
 7. Field Piping Connections: Manufacturer's standard.
 8. Factory Charge: Dehydrated air or nitrogen.
 9. Testing: Factory pressure tested and verified to be without leaks.
- D. Drain Assembly:
1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
 2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
 3. Field Piping Connection: Non-ferrous material.
- E. Fan and Motor Assembly:
1. Fan(s):
 - a. Direct-drive arrangement.
 - b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
 - c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
 - d. Wheels statically and dynamically balanced.
 2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
 3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
 5. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Filter Assembly:
1. Access: Bottom, to accommodate filter replacement without the need for tools.
 2. Efficiency: ASHRAE 52.2, MERV 8.
 3. Media:
 - a. Washable: Manufacturer's standard filter with antimicrobial treatment.
- G. Discharge-Air Grille Assembly: Mounted in bottom of unit cabinet.
1. Discharge Pattern: One-, two-, three-, or four-way throw as indicated on Drawings.
 - a. Discharge Pattern Adjustment: Field-adjustable limits for up and down range of motion.

- b. Discharge Pattern Closure: Ability to close individual discharges of units with multiple patterns.
 2. Motorized Vanes: Modulating up and down flow pattern for uniform room air distribution.
 3. Additional Branch Supply Duct Connection: Sheet metal knockout for optional connection to one additional supply branch duct.
- H. Return-Air Grille Assembly: Manufacturer's standard grille mounted in bottom of unit cabinet.
- I. Outdoor Air Ventilation Connection: Sheet metal knockout for optional connection to outdoor air ventilation duct.
- J. Unit Accessories:
 1. Outdoor Air Ventilation Kit: Connection, motorized damper, and control to satisfy unit control sequence of operation indicated on Drawings.
 2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
- K. Unit Controls:
 1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
 2. Factory-Installed Controller: Configurable digital control.
 3. Factory-Installed Sensors: Unit inlet air temperature.
 4. Field-Customizable I/O Capability:
 - a. Analog Inputs: Four for use in customizable control strategies.
 - b. Digital Inputs: Four for use in customizable control strategies.
 - c. Digital Outputs: Four for use in customizable control strategies.
 5. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification, run test switch.
 6. Communication: Network communication with other indoor units and outdoor unit(s).
 7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- L. Unit Electrical:
 1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
 2. Field Connection: Single point connection to power entire unit and integral controls.
 3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.

5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

2.6 INDOOR, DEDICATED 100% OUTSIDE AIR VENTILATION UNITS

- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

1. Specially designed for up to 100 percent outdoor air entering unit.

- B. Cabinet:

1. Material: Galvanized steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

- C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

- D. DX Coil Assembly for Reheat Applications: Provide units with a reheat coil where indicated on Drawings.

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

E. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted pump or other integral lifting mechanism, capable of lifting drain water to an elevation above top of cabinet.
3. Field Piping Connection: Non-ferrous material.

F. Fan and Motor Assembly:

1. Fan(s):
 - a. Direct-drive arrangement.
 - b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
 - c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
 - d. Wheels statically and dynamically balanced.
2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

G. Filter Box Assembly:

1. Access: Bottom, side, or rear to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.
2. Efficiency: ASHRAE 52.2, MERV 13.
3. Replaceable Media: Extended surface, panel, or cartridge with antimicrobial treatment fiber media.
4. Filter box shall be field installed. Mount filter box with service clearances to allow for filter access and replacement.

H. Unit Accessories:

1. Motorized Inlet Damper Kit: Low-leakage damper with spring return electric actuator to fail closed on loss of power. Damper controlled by unit to open when unit is operating and close when unit off.

I. Unit Controls:

1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Coil entering refrigerant temperature, Coil leaving refrigerant temperature, Unit entering-air temperature, Unit leaving-air temperature, Unit entering-air relative humidity, Unit leaving-air relative humidity.
4. Field-Customizable I/O Capability:
 - a. Analog Inputs: Four for use in customizable control strategies.

- b. Digital Inputs: Four for use in customizable control strategies.
 - c. Digital Outputs: Four for use in customizable control strategies.
5. Features and Functions: Self-diagnostics, time delay, auto-restart, external static pressure control, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification, run test switch.
 6. Communication: Network communication with other indoor units and outdoor unit(s).
 7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- J. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
 2. Field Connection: Single point connection to power entire unit and integral controls.
 3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- 2.7 OUTDOOR, AIR-SOURCE HEAT RECOVERY (SIMULTANEOUS HEAT & COOL) UNITS
- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
1. Specially designed for use in systems with simultaneous heating and cooling.
 2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
 3. All units installed shall be from the same product development generation.
- B. Cabinet:
1. Galvanized steel and coated with a corrosion-resistant finish.
 - a. Coating with documented salt spray test performance of 960 hours according ASTM B 117 surface scratch test (SST) procedure.
 2. Mounting: Manufacturer-designed provisions for field installation.
 3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
 2. Protection: Integral protection against the following:
 - a. High refrigerant pressure.
 - b. Low oil level.
 - c. High oil temperature.
 - d. Thermal and overload.
 - e. Voltage fluctuations.
 - f. Phase failure and phase reversal.
 - g. Short cycling.
 3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
 4. Vibration Control: Integral isolation to dampen vibration transmission.
 5. Oil management system to ensure safe and proper lubrication over entire operating range.
 6. Crankcase heaters with integral control to maintain safe operating temperature.
 7. Fusible plug.
- D. Condenser Coil Assembly:
1. Plate Fin Coils:
 - a. Casing: Aluminum, galvanized, or stainless steel.
 - b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
 - c. Tubes: Copper, of diameter and thickness required by performance.
 2. Aluminum Microchannel Coils:
 - a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
 - b. Single- or multiple-pass arrangement.
 - c. Construct fins, tubes, and header manifolds of aluminum alloy.
 3. Corrosion Protection: Coating with documented salt spray test performance of 900 hours according ASTM B 117 surface scratch test (SST) procedure.
 4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
- E. Condenser Fan and Motor Assembly:
1. Fan(s): Propeller type.
 - a. Direct-drive arrangement.
 - b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
 - c. Statically and dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
 3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
 4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
 6. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.
- G. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
 2. Factory-Installed Controller: Configurable digital control.
 3. Factory-Installed Sensors:
 - a. Refrigerant suction temperature.
 - b. Refrigerant discharge temperature.
 - c. Outdoor air temperature.
 - d. Refrigerant high pressure.
 - e. Refrigerant low pressure.
 - f. Oil level.
 4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode, night setback control, power consumption display, run test switch equalize run time between multiple same components.
 5. Communication: Network communication with indoor units and other outdoor unit(s).
 6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- H. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
 2. Field Connection: Single point connection to power entire unit and integral controls.
 3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- I. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.
 2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.

3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.8 OUTDOOR, AIR-SOURCE (100% OUTSIDE AIR) HEAT RECOVERY UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with simultaneous heating and cooling connected to a dedicated 100% outside air indoor unit.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.
 - a. Coating with documented salt spray test performance of 960 hours according ASTM B 117 surface scratch test (SST) procedure.
2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:
 - a. High refrigerant pressure.
 - b. Low oil level.
 - c. High oil temperature.
 - d. Thermal and overload.
 - e. Voltage fluctuations.
 - f. Phase failure and phase reversal.
 - g. Short cycling.
3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:
 - a. Casing: Aluminum, galvanized, or stainless steel.
 - b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
 - c. Tubes: Copper, of diameter and thickness required by performance.
 2. Aluminum Microchannel Coils:
 - a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
 - b. Single- or multiple-pass arrangement.
 - c. Construct fins, tubes, and header manifolds of aluminum alloy.
 3. Corrosion Protection: Coating with documented salt spray test performance of 900 hours according ASTM B 117 surface scratch test (SST) procedure.
 4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
- E. Condenser Fan and Motor Assembly:
1. Fan(s): Propeller type.
 - a. Direct-drive arrangement.
 - b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
 - c. Statically and dynamically balanced.
 2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
 3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
 4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
 6. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.
- G. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
 2. Factory-Installed Controller: Configurable digital control.
 3. Factory-Installed Sensors:
 - a. Refrigerant suction temperature.
 - b. Refrigerant discharge temperature.
 - c. Outdoor air temperature.
 - d. Refrigerant high pressure.

- e. Refrigerant low pressure.
 - f. Oil level.
- 4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection, auto operation mode, manual operation mode, night setback control, power consumption display, run test switch equalize run time between multiple same components.
 - 5. Communication: Network communication with indoor units and other outdoor unit(s).
 - 6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 - 7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- H. Unit Electrical:
- 1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
 - 2. Field Connection: Single point connection to power entire unit and integral controls.
 - 3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
 - 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 - 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- I. Unit Piping:
- 1. Unit Tubing: Copper tubing with brazed joints.
 - 2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
 - 3. Field Piping Connections: Manufacturer's standard.
 - 4. Factory Charge: Dehydrated air or nitrogen.
 - 5. Testing: Factory pressure tested and verified to be without leaks.

2.9 HEAT RECOVERY CONTROL UNITS (HRCUs)

- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
- 1. Specially designed for use in systems with simultaneous heating and cooling.
 - 2. Systems shall consist of one unit, or multiple unit that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
- B. Cabinet:
- 1. Galvanized-steel construction.
 - 2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
 - 3. Mounting: Manufacturer-designed provisions for field installation.

4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.
- D. Refrigeration Assemblies and Specialties:
1. Specially designed by manufacturer for type of VRF HVAC system being installed, either two or three pipe.
 2. Each refrigerant branch circuit shall have refrigerant control valve(s) to control refrigerant flow.
 3. Spares: Each heat recovery control unit shall include at least two branch circuit port(s) for future use.
 4. Each system piping connection upstream of heat recovery unit shall be fitted with an isolation valve to allow for service to any heat recovery control unit in the system without interrupting operation of the system.
 5. Each branch circuit connection shall be fitted with an isolation valve and capped service port to allow for service to any individual branch circuit without interrupting operation of the system.
 - a. If not available as an integral part of the heat recovery control unit, isolation valves shall be field installed adjacent to the unit pipe connection.
- E. Unit Controls:
1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
 2. Factory-Installed Controller: Configurable digital control.
 3. Communication: Network communication with indoor units and outdoor unit(s).
 4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- F. Unit Electrical:
1. Enclosure: Metal, similar to enclosure, and suitable for indoor locations.
 2. Field Connection: Single point connection to power entire unit and integral controls.
 3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
 5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- G. Unit Piping:
1. Unit Tubing: Copper tubing with brazed joints.
 2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.

3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.10 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units, HRCUs, and outdoor units shall include integral controls and connect through a TIA-485A or manufacturer-selected control network.
2. Network Communication Protocol: open control communication between interconnected units.
3. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:
 - a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
 - b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes of battery backup operation after a power loss.
 - c. Integration shall include monitoring, scheduling, change of value notifications.
4. Operator Interface:
 - a. Operators shall interface with system and unit controls through the following:
 - 1) Operator interfaces integral to controllers.
 - 2) Owner-furnished PC connected to central controller(s).
 - 3) Web interface through web browser software.
 - 4) Integration with Building Automation System.
 - 5) Phone application.
 - b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:
 - 1) On/off control.
 - 2) Temperature set-point adjustment.

B. VRF HVAC System Operator Software for PC and phone application:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.

4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Multiple Languages: English.
10. Supports Imperial and Metric Temperature Units: Fahrenheit and Celsius. Units shall be set in Fahrenheit.
11. Displays service notifications and error codes.
12. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
13. Monitors and displays cumulative operating time of indoor units.
14. Able to disable and enable operation of individual controllers for indoor units.
15. Information displayed on individual controllers shall also be available for display.
16. Information displayed for outdoor units, including refrigerant high and low pressures.

C. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.
 - a. Include multiple interconnected controllers as required.
2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
 - a. Sets schedule for daily, weekly, and annual events.
 - b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.
4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures.

11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.

D. Building Connect System

1. Cloud based controller interlocked with the main central controller to allow for owner control through mobile application.
 - a. Include a BCP-50 model controller.

E. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English.
4. Temperature Units: Fahrenheit and Celsius. Unit shall be set in Fahrenheit.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter".
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.11 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. R-410a.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.12 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing:

1. Drawn-Temper Tubing: According to ASTM B 88, Type L or Type DWV according to ASTM B 306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B 32, lead-free alloys, and water-flushable flux according to ASTM B 813.

C. PVC plastic pipe according to ASTM D 1785, Schedule 40, with socket-type pipe fittings according to ASTM D 2466 and solvent cement according to ASTM D 2564, primer according to ASTM F 656.

2.13 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Piping:

1. Copper Tube: ASTM B 280, Type ACR.
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.

C. Refrigerant Tubing Kits:

1. Furnished by VRF HVAC system manufacturer.
2. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.
5. Factory Charge: Dehydrated air or nitrogen.

D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

E. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.14 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized or copper-coated steel.

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel.

2.15 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
2. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with inturred lips.
4. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
6. Metallic Coating for Use Indoors: Electroplated zinc, hot-dip galvanized, or mill galvanized.
7. Plastic Coating for Use Outdoors: PVC, polyurethane, epoxy, or polyester.

2.16 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: Zinc-coated or stainless steel.

2. Outdoor Applications: Stainless steel.

2.17 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 2. Base: Stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 2. Bases: One or more; plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.18 MISCELLANEOUS SUPPORT MATERIALS

- A. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.
- B. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.

- C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.19 PIPING AND TUBING INSULATION

- A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.

2.20 SYSTEM CONTROL CABLE

- A. Cable Rating: Listed and labeled for application according to NFPA 70.
 - 1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - a. Flame Travel Distance: 60 inches or less.
 - b. Peak Optical Smoke Density: 0.5 or less.
 - c. Average Optical Smoke Density: 0.15 or less.
 - 2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
 - 3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- B. Low-Voltage Control Cabling:
 - 1. Paired Cable: NFPA 70, Type CMG.
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
 - b. PVC insulation.
 - c. Braided or foil shielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1685.
 - 2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
 - a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
 - b. PVC insulation.
 - c. Braided or foil shielded.
 - d. PVC jacket.
 - e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
 - f. Flame Resistance: Comply with NFPA 262.

- C. TIA-485A Network Cabling:
 - 1. Standard Cable: NFPA 70, Type CMG.
 - a. Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. PVC insulation.
 - c. Unshielded.
 - d. PVC jacket.
 - e. Flame Resistance: Comply with UL 1685.
 - 2. Plenum-Rated Cable: NFPA 70, Type CMP.
 - a. Paired, two pairs, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - b. Fluorinated ethylene propylene insulation.
 - c. Unshielded.
 - d. Fluorinated ethylene propylene jacket.
 - e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
 - f. Flame Resistance: NFPA 262.
- D. Ethernet Network Cabling: TIA-568-C.2 Category 6a cable with RJ-45 connectors.
 - 1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
 - 2. Conductors: 100-ohm, 23 AWG solid copper.
 - 3. Shielding: Per manufacturer's recommendation.
 - 4. Cable Rating: By application.
 - 5. Jacket: White thermoplastic.

2.21 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect factory-assembled equipment.
- B. Equipment will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports for historical record. Submit reports only if requested.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.

- C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.
- D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.
- E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.
- F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.
- G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

- A. Clearance:
 - 1. Maintain manufacturer's recommended clearances for service and maintenance.
 - 2. Maintain clearances required by governing code.
- B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.
 - 1. Loose components shall be installed by system Installer under supervision of manufacturer's service representative.

3.3 INSTALLATION OF INDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.
- C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.
- D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.
- E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.
- F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

- G. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.
- H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.
- I. Install floor-mounted units on support structure indicated on Drawings.
- J. Install floor-mounted units on cast-in-place concrete equipment bases.
- K. Attachment: Install hardware for proper attachment to supported equipment.
- L. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

- A. Install units to be level and plumb while providing a neat and finished appearance.
- B. Install outdoor units on support structures indicated on Drawings.
- C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases.
 - 1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 2. Grouting: Place grout under equipment supports and make bearing surface smooth.
- D. Roof-Mounted Installations: Install outdoor units on equipment supports. Anchor units to supports with removable, stainless-steel fasteners.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping and tubing to permit valve servicing.
- F. Install piping and tubing at indicated slopes.

- G. Install piping and tubing free of sags.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping and tubing to allow application of insulation.
- J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.
- K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors.
- L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors.

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

- 1. Install a union in piping at each threaded unit connection.
- 2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
- 3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:
 - a. Details indicated on Drawings.
 - b. Manufacturer's requirements.
 - c. Governing codes.
 - d. In the absence of requirements, comply with requirements of ASHRAE handbooks.
- 4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
- 5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

- 1. Slope piping from unit connection toward drain termination at a constant slope of not less than two percent.

C. Pumped Drains:

- 1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.7 INSTALLATION OF REFRIGERANT PIPING

- A. Refrigerant Tubing Kits:
1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
 2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
 3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.
- B. Install refrigerant piping according to ASHRAE 15 and governing codes.
- C. Select system components with pressure rating equal to or greater than system operating pressure.
- D. Install piping as short and direct as possible, with a minimum number of joints and fittings.
- E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.
- F. Install refrigerant piping and tubing in protective conduit where installed belowground.
- G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.
- H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:
1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
 2. Install horizontal suction lines with a uniform slope downward to compressor.
 3. Install traps to entrain oil in vertical runs.
 4. Liquid lines may be installed level.
- I. When brazing, remove or protect components that could be damaged by heat.
- J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.
- K. Joint Construction:
1. Ream ends of tubes and remove burrs.
 2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
 3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

- a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
- b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.8 INSTALLATION OF METAL HANGERS AND SUPPORTS

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- C. Comply with MFMA-103 for metal framing system selections and applications that are not specified.
- D. Fastener System Installation:
 1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
 3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- E. Pipe Stand Installation:
 1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel.
 1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Piping and Tubing Insulation:
1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 2. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
- M. Horizontal-Piping Hangers and Supports: Install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu of individual clevis hangers.
 5. Pipe stands for horizontal pipes located outdoors.
 6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- N. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:
1. Sizes through NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- O. Plastic Pipe Hanger and Support Spacing:
1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
 2. Maximum spacing, 5 feet; minimum rod size, 1/4 inch.
- P. Vertical-Piping Clamps: Install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8).

2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.
- Q. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed 10 feet.
- R. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.
- S. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.
- T. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- U. Trim excess length of continuous-thread hanger and support rods to 1 inch.
- V. Hanger-Rod Attachments: Install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- W. Building Attachments: Install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.9 INSTALLATION OF PIPING AND TUBING INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.
- B. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- E. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

- A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.
- B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."
- C. Comply with requirements for nonmetal ducts specified in Section 233116 "Nonmetal Ducts."

- D. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."
- E. Comply with requirements for flexible ducts specified in Section 233346 "Flexible Ducts."
- F. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."
- G. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

3.11 ELECTRICAL INSTALLATION

- A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.
- B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.
 - 1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.
- C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.
- D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- E. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections.
- F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
 - 2. Locate nameplate or label where easily visible.
- G. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.
 - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
 - 2. Outlet boxes for cables shall be no smaller than 4 inches square by 1-1/2 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
 - 3. Flexible metal conduit shall not be used.
- H. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

- I. Install manufactured conduit sweeps and long-radius elbows if possible.
- J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.12 SOFTWARE

A. Cybersecurity:

1. Software:

- a. Coordinate security requirements with IT department or entity responsible for IT security.
- b. Ensure that latest stable software release is installed and properly operating.
- c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.

2. Hardware:

- a. Coordinate location and access requirements with IT department or entity responsible for IT security.
- b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
- c. Disable dual network connections.

3.13 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

- a. Within equipment and associated control enclosures.
- b. In accessible ceiling spaces where open cable installation method may be used.
- c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

- 1. Comply with TIA-568-C Series of standards.
- 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
- 3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
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 ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.14 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.15 GROUNDING INSTALLATION

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.16 IDENTIFICATION

- A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."
- B. Identify system electrical and controls components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.17 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.
 - 1. Field service shall be performed by a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.
 - a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.
 - 2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.
 - a. First Visit: Kick-off meeting.
 - b. Second Visit: At approximately 25 percent completion of system(s).
 - c. Third Visit: At approximately 50 percent completion of system(s).
 - d. Fourth Visit: At approximately 75 percent completion of system(s).

- e. Fifth Visit: Final inspection before system startup.
3. Kick-off Meeting:
- a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
 - b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
 - c. Meeting shall cover the following as a minimum requirement:
 - 1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
 - 2) Manufacturer's installation requirements specific to systems being installed.
 - 3) Review of all relevant VRF HVAC system submittals, including delegated-design submittals.
 - 4) Required field activities related installation of VRF HVAC system.
 - 5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.
4. Site Visits: Activities for each site visit shall include the following:
- a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
 - b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
 - c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
 - d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
 - e. Issue a report for each visit, documenting the visit.
 - 1) Report to include name and contact information of individual making the visit.
 - 2) Date(s) and time frames while on-site.
 - 3) Names and contact information of people meeting with while on-site.
 - 4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.
5. Final Inspection before Startup:
- a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.

- b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
- c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
- d. Inspection reports for indoor units shall include, but not be limited to, the following:
 - 1) Unit designation on Drawings.
 - 2) Manufacturer model number.
 - 3) Serial number.
 - 4) Network address, if applicable.
 - 5) Each equipment setting.
 - 6) Mounting, supports, and restraints properly installed.
 - 7) Proper service clearance provided.
 - 8) Wiring and power connections correct.
 - 9) Line-voltage reading(s) within acceptable range.
 - 10) Wiring and controls connections correct.
 - 11) Low-voltage reading(s) within an acceptable range.
 - 12) Controller type and model controlling unit.
 - 13) Controller location.
 - 14) Temperature settings and readings within an acceptable range.
 - 15) Humidity settings and readings within an acceptable range.
 - 16) Condensate removal acceptable.
 - 17) Fan settings and readings within an acceptable range.
 - 18) Unit airflow direction within an acceptable range.
 - 19) If applicable, fan external static pressure setting.
 - 20) Filter type and condition acceptable.
 - 21) Noise level within an acceptable range.
 - 22) Refrigerant piping properly connected and insulated.
 - 23) Condensate drain piping properly connected and insulated.
 - 24) If applicable, ductwork properly connected.
 - 25) If applicable, external interlocks properly connected.
 - 26) Remarks.
- e. Inspection reports for outdoor units shall include, but not be limited to, the following:
 - 1) Unit designation on Drawings.
 - 2) Manufacturer model number.
 - 3) Serial number.
 - 4) Network address, if applicable.
 - 5) Each equipment setting.
 - 6) Mounting, supports, and restraints properly installed.
 - 7) Proper service clearance provided.
 - 8) Wiring and power connections correct.
 - 9) Line-voltage reading(s) within acceptable range.
 - 10) Wiring and controls connections correct.

- 11) Low-voltage reading(s) within an acceptable range.
 - 12) Condensate removal acceptable.
 - 13) Noise level within an acceptable range.
 - 14) Refrigerant piping properly connected and insulated.
 - 15) Condensate drain piping properly connected and insulated.
 - 16) Remarks.
- f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:
- 1) Unit designation on Drawings.
 - 2) Manufacturer model number.
 - 3) Serial number.
 - 4) Network address, if applicable.
 - 5) Each equipment setting.
 - 6) Mounting, supports, and restraints properly installed.
 - 7) Proper service clearance provided.
 - 8) Wiring and power connections correct.
 - 9) Line-voltage reading(s) within acceptable range.
 - 10) Wiring and controls connections correct.
 - 11) Low-voltage reading(s) within an acceptable range.
 - 12) Controller type and model controlling unit.
 - 13) Controller location.
 - 14) Temperature settings and readings within an acceptable range.
 - 15) Humidity settings and readings within an acceptable range.
 - 16) Condensate removal acceptable.
 - 17) Fan settings and readings within an acceptable range.
 - 18) Fan external static pressure setting.
 - 19) Filter type and condition acceptable.
 - 20) Noise level within an acceptable range.
 - 21) Refrigerant piping properly connected and insulated.
 - 22) Condensate drain piping properly connected and insulated.
 - 23) Automatic dampers properly installed and operating.
 - 24) Ductwork properly connected.
 - 25) If applicable, external interlocks properly connected.
 - 26) Remarks.
- g. Inspection reports for energy recovery ventilators shall include, but not be limited to, the following:
- 1) Unit designation on Drawings.
 - 2) Manufacturer model number.
 - 3) Serial number.
 - 4) Network address, if applicable.
 - 5) Each equipment setting.
 - 6) Mounting, supports, and restraints properly installed.
 - 7) Proper service clearance provided.
 - 8) Wiring and power connections correct.
 - 9) Line-voltage reading(s) within acceptable range.

- 10) Wiring and controls connections correct.
 - 11) Low-voltage reading(s) within an acceptable range.
 - 12) Controller type and model controlling unit.
 - 13) Controller location.
 - 14) Temperature settings and readings within an acceptable range.
 - 15) Humidity readings.
 - 16) Condensate removal acceptable.
 - 17) Fan settings and readings within an acceptable range.
 - 18) Fan external static pressure setting.
 - 19) Filter type and condition acceptable.
 - 20) Noise level within an acceptable range.
 - 21) Automatic dampers properly installed and operating.
 - 22) Ductwork properly connected.
 - 23) If applicable, external interlocks properly connected.
 - 24) Remarks.
- h. Inspection reports for hydronic units shall include, but not be limited to, the following:
- 1) Unit designation on Drawings.
 - 2) Manufacturer model number.
 - 3) Serial number.
 - 4) Network address, if applicable.
 - 5) Each equipment setting.
 - 6) Mounting, supports, and restraints properly installed.
 - 7) Proper service clearance provided.
 - 8) Wiring and power connections correct.
 - 9) Line-voltage reading(s) within acceptable range.
 - 10) Wiring and controls connections correct.
 - 11) Low-voltage reading(s) within an acceptable range.
 - 12) Controller type and model controlling unit.
 - 13) Controller location.
 - 14) Temperature settings and readings within an acceptable range.
 - 15) Condensate removal acceptable.
 - 16) Noise level within an acceptable range.
 - 17) Refrigerant piping properly connected and insulated.
 - 18) Hydronic piping properly connected and insulated.
 - 19) Proof of water flow checked for proper operation.
 - 20) Condensate drain piping properly connected and insulated.
 - 21) If applicable, external interlocks properly connected.
 - 22) Remarks.
- i. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
- j. Installer shall correct observed deficiencies found by the inspection.
- k. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.

- l. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
 - m. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.
 - B. Perform the following tests and inspections with the assistance of manufacturer's service representative:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - C. Refrigerant Tubing Positive Pressure Testing:
 1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
 2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.5 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
 3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
 4. Prepare test report to record the following information for each test:
 - a. Name of person starting test, company name, phone number, and e-mail address.
 - b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
 - c. Detailed description of extent of tubing tested.
 - d. Date and time at start of test.
 - e. Test pressure at start of test.
 - f. Outdoor temperature at start of test.
 - g. Name of person ending test, company name, phone number, and e-mail address.
 - h. Date and time at end of test.
 - i. Test pressure at end of test.
 - j. Outdoor temperature at end of test.
 - k. Remarks:
 5. Submit test reports for Project record.
 - D. Refrigerant Tubing Evacuation Testing:
 1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.

2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Prepare test report to record the following information for each test:
 - a. Name of person starting test, company name, phone number, and e-mail address.
 - b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
 - c. Detailed description of extent of tubing tested.
 - d. Date and time at start of test.
 - e. Test pressure at start of test.
 - f. Outdoor temperature at start of test.
 - g. Name of person ending test, company name, phone number, and e-mail address.
 - h. Date and time at end of test.
 - i. Test pressure at end of test.
 - j. Outdoor temperature at end of test.
 - k. Remarks:
5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.18 STARTUP SERVICE

- A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.
1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
 2. Complete startup service of each separate system.
 3. Complete system startup service according to manufacturer's written instructions.
- B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
 2. Check each indoor unit's response to demand for cooling and heating.
 3. Check each indoor unit's response to changes in airflow settings.
 4. Check each indoor unit, HRCU, and outdoor unit for proper condensate removal.
 5. Check sound levels of each indoor and outdoor unit.
- C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.
1. Installer shall correct deficiencies found during startup service for reverification.
- D. System Operation Report:
1. After completion of startup service, manufacturer shall issue a report for each separate system.
 2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
 3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.
 - a. All available system operating parameters shall be included in the information submitted.
- E. Witness:
1. Invite Architect, Owner, and Commissioning Agent to witness startup service procedures.
 2. Provide written notice not less than 20 business days before start of startup service.

3.19 ADJUSTING

- A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.
- C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.
- D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.20 PROTECTION

- A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

- B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.
- C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.
- D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.21 DEMONSTRATION

- A. Engage a VRF HVAC system manufacturer's factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.
- B. Instructor:
 - 1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
 - 2. Instructor's credentials shall be submitted for review by Architect, Commissioning Agent, and Owner before scheduling training.
 - 3. Instructor(s) primary job responsibility shall be Owner training.
 - 4. Instructor(s) shall have not less than three years of training experience with VRF HVAC system manufacturer and past training experience on at least three projects of comparable size and complexity.
- C. Schedule and Duration:
 - 1. Schedule training with Owner at least 20 business days before first training session.
 - 2. Training shall occur before Owner occupancy.
 - 3. Training shall be held at mutually agreed date and time during normal business hours.
 - 4. Each training day shall not exceed eight hours of training. Daily training schedule shall allow time for one-hour lunch period and 15-minute break after every two hours of training.
 - 5. Perform not less than 24 total hours of training.
- D. Location: Owner shall provide a suitable on-site location to host classroom training.
- E. Training Attendees: Assume three people.
- F. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.
- G. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.
- H. Training Materials: Provide training materials in electronic format to each attendee.
 - 1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.

2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.
 - I. Acceptance: Obtain Owner written acceptance that training is complete and requirements indicated have been satisfied.

END OF SECTION 23 70 10

SECTION 23 70 30 – AIR PURIFICATION SYSTEM

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. This section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit or mounted on the duct as shown on the plans, details and equipment schedules.

1.02 REFERENCED CODES & STANDARDS

- A. The following codes and standards are referenced throughout. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

- 1. ASHRAE Standards 62 & 52
- 2. National Electric Code NFPA 70
- 3. UL 867 including ozone chamber test

1.03 RELATED WORK

- A. Testing, Adjusting and Balancing
- B. Facility Access and Protection
- C. Ductwork
- D. Filters
- E. Electrical Wiring
- F. Control Wiring

1.04 QUALITY ASSURANCE

- A. The Air Purification System shall be a product of an established manufacturer in the USA and shall be manufactured and assembled in the USA.
- B. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
- C. Technologies that do not address gas disassociation such as UV lights, powered particulate filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable.

- D. Projects designed using ASHRAE Standard 62.1 IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled. The manufacturer shall provide independent test data on a previous installation in a similar application that proves compliance to ASHRAE 62.1 and the accuracy of the calculations.
- E. The Air Purification Technology shall have been tested by UL or Intertek/ETL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. All manufacturers shall submit their independent UL 867 test data with ozone results to the engineer during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.
- F. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.001 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.0012 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

1.05 SUBMITTALS

- A. Submit manufacturer's technical product data for ion generators including:
 - 1. Schedule of plasma generators indicating model number and quantity of each type required for each unit/application.
 - 2. Submittal sheet for each type of plasma generator and accessories furnished; indicating construction, dimensions, electrical data, and mounting details.
 - 3. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled (when projects are designed with reduced outside air).
 - 4. Product drawings detailing all physical, electrical and control requirements.
 - 5. Copy of UL 867 independent ozone test.
- B. Operating & Maintenance Data: Submit O&M data and recommended spare parts list.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of products shall be in factory fabricated shipping cartons. Identify on outside of carton the type of product contained within. Avoid crushing or bending.
- B. Store in original cartons and protect from weather and construction work traffic.
- C. Store indoors and in accordance with the manufacturers' recommendation for storage.

1.07 WARRANTY

- A. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of twelve months after shipment or eighteen months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

PART 2 – PRODUCTS

2.01 GENERAL

- A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be manufactured by Plasma Air International (www.plasma-air.com). Equal by Aerisa (www.aerisa.com) shall also be acceptable.
- B. All other suppliers of comparable products requesting prior approval shall:
 - 1. Submit a request for prior approval at least 15 days prior to bid date. Request received after that time will not be considered.
 - 2. In addition, as part of the prior approval request, Bipolar Ionization manufacturers must submit their IAQ calculations that prove conformance to ASHRAE Standard 62.1-2007 with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application shall also be included.
 - 3. Submit independent test data from ETL or UL on the ozone chamber test.
 - 4. Submit pathogen testing per section 2.2.
 - 5. Submit at least two other end user references in the same application with contact phone number, email, equipment used and application for the equipment at that facility. Manufacturers not having the above references in similar applications using the same equipment models as proposed on the current project shall not be acceptable.

2.02 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

- A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator with bipolar ionization output as described here within.
- B. The Bi-polar Ionization system shall be capable of:
 - 1. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).
 - 2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
 - 3. Reducing space static charges.
 - 4. Reducing space particle counts.
 - 5. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.
 - 6. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
 - 1. MRSA: 99.5% in 60 minutes or less
 - 2. E. Coli: 93.5% in 30 minutes or less
 - 3. H1N1: 86.6% in 60 minutes or less
 - 4. Aspergillus: 74.8% in 60 minutes or less

- Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELEC accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6a, 6b and 6c.
- C. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.
1. Airflow rates may vary through the full operating range of a VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
 2. Velocity Profile: The air purification device shall not have a maximum velocity profile.
- D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions to the air purification system.
- E. Ionization Equipment Requirements:
1. Electrode Specifications (Bi-polar Ionization):
 - a. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
 - b. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
 - c. Ionization output from each electrode shall be a minimum of 5 million ions/cc when tested at 2" from the ion generator.
 - d. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air stream will not be accepted.
 2. Air Handler mounted units
 - a. Ion generators for air handling unit coils shall be Plasma Air[®] BAR product furnished in a linear or bar mounted configuration so as to minimize the space required for installation. Ionization "BAR" shall be no more than 3" deep in the direction of airflow.
 - b. The mechanical contractor shall mount the plasma ionization bar and wire it to the remote mount power supply panel using only low voltage wiring. Low voltage wiring shall be defined as 12V. The use of high voltage cabling (600V or higher) shall not be acceptable due to safety concerns.
 - c. The remote mount power supply panel shall be capable of directly accepting voltage of 12V DC or 24V AC. The panel shall have an on/off switch, ionizer indicator LED, and a set of dry contacts which will indicate ionizer functionality. Dry contacts that indicate power available only shall not be acceptable.

- d. For systems without dry contacts, provide a duct mounted ion sensor powered from 12V DC or 24V AC. Ion sensor to be user adjustable from 500 to 20,000 ions per cm³.

3. Variable Refrigerant Flow (VRF) units

- a. Ion generators for VRF units shall be brush type needlepoint units similar to Plasma Air model PA600 designed to be mounted at the fan inlet.
- b. The unit shall be rated to treat up to 2,400 CFM or 6 tons nominal capacity. For airflows greater than 2,400 CFM, multiple units shall be utilized.
- c. The PA600 housing is made from ABS plastic, contains an LED ionization output indicating LED, and an in-line 1 Amp fuse.
- d. The unit shall contain two (2) mounting feet and shall be configured so the needles are oriented perpendicular to the flow of air into entering the fan wheel.

4. Certifications

- a. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners.
- b. The operation of the electrodes or bipolar ionization units shall conform to UL 867 with respect to ozone generation.

F. Electrical Requirements:

1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the fan coil unit or air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
2. Wiring, conduit and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.

G. Control Requirements:

1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
2. All plasma ion generators shall include an external BMS interface to indicate ion generator status and alarm.

PART 3 – EXECUTION

3.01 GENERAL

- A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building (Owner Acceptance).

3.02 ASSEMBLY & INSTALLATION: PLASMA GENERATOR WITH BI-POLAR IONIZATION

- A. All equipment shall be assembled and installed with a high level of workmanship to the satisfaction of the owner, architect and engineer.
- B. Any material damaged by handling, water or moisture shall be replaced by the mechanical contractor at no cost to the owner.
- C. All equipment shall be protected from damage on a daily basis throughout construction.

3.03 COMMISSIONING & TRAINING

- A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.
- B. Provide to the owner a portable hand held ion counter with a calibrated range of 0 to 20,000 ions/cm³ and an accuracy of +/- 25% within the specified range. Ion counter shall have automatic zeroing capability on 10 minute intervals.

END OF SECTION 23 70 30

SECTION 23 81 27 – MINI-SPLIT-SYSTEM (1 TO 1) AIR-CONDITIONERS

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 mini split-system DX air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.
- B. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:
 - a. For Compressor: Five year(s) from date of Substantial Completion.
 - b. For Parts: Five year(s) from date of Substantial Completion.
 - c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Mitsubishi (Basis of Design)

2.2 P-SERIES OUTDOOR UNIT

- A. General: The outdoor units shall be equipped with multiple circuit boards that interface to the M-NET controls system and shall perform all functions necessary for operation. The outdoor unit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory.
- B.
 - 1. Outdoor unit shall have a sound rating no higher than 59 dB(A).
 - 2. Both refrigerant lines from the outdoor unit to indoor units shall be individually insulated.
 - 3. The outdoor unit shall have an accumulator with refrigerant level sensors and controls.
 - 4. The outdoor unit shall have a high pressure safety switch, low pressure safety switch and over-current protection and DC bus protection.
 - 5. The outdoor unit shall be capable of cooling operation down to 23°F outdoor ambient without additional low ambient controls.
 - 6. The outdoor unit shall have a high efficiency oil separator plus additional logic controls to ensure adequate oil volume in the compressor is maintained.
- C. Unit Cabinet:
 - 1. The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.
- D. Fan:
 - 1. The unit shall be furnished with two direct drive, variable speed motors.
 - 2. The fans will be forward curved type blades for quiet operation.
 - 3. The fan motor shall have inherent protection, have permanently lubricated bearings, and be completely variable speed.
 - 4. The fan motor shall be mounted for quiet operation.
 - 5. The fan shall be provided with a raised guard to prevent contact with moving parts.
 - 6. The outdoor unit shall have horizontal discharge airflow.

- E. Refrigerant
 - 1. R410A refrigerant shall be required for all S-Series outdoor unit systems.
- F. Coil:
 - 1. The outdoor coil shall be of nonferrous construction with lanced or corrugated fins on copper tubing.
 - 2. The coil fins will have a factory applied corrosion resistant blue-fin finish.
 - 3. The coil shall be protected with an integral metal guard.
 - 4. Refrigerant flow from the outdoor unit shall be controlled by means of an inverter driven compressor.
- G. Compressor:
 - 1. The compressor shall be a single high performance, inverter driven, modulating capacity scroll compressor.
 - 2. The compressor shall be equipped with an internal thermal overload.
 - 3. The compressor shall be mounted to avoid the transmission of vibration.
- H. Electrical:
 - 1. The outdoor unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
 - 2. The unit shall be capable of satisfactory operation within voltage limitations of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)
 - 3. The outdoor unit shall be controlled by integral microprocessors.
 - 4. The control circuit between the indoor units and the outdoor unit shall be 24VDC completed using a 2-conductor, twisted pair, non-polar shielded cable to provide total integration of the system.

2.3 PKA (Wall Mounted) INDOOR UNIT

- A. General:
 - 1. The PKA shall be a wall-mounted indoor unit section and shall have a modulating linear expansion device and a flat front. The PKA shall be used with the P-Series outdoor unit. The PKA shall support individual control using M-NET DDC controllers.
- B. Indoor Unit
 - 1. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, and a test run switch. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.
- C. Unit Cabinet:
 - 1. All casings, regardless of model size, shall have the same white finish
 - 2. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.
 - 3. There shall be a separate back plate which secures the unit firmly to the wall.
- D. Fan:
 - 1. The indoor fan shall be an assembly with one or two line-flow fan(s) direct driven by a single motor.
 - 2. The indoor fan shall be statically and dynamically balanced to run on a motor with permanently lubricated bearings.

3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
 4. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.
- E. Filter:
1. Return air shall be filtered by means of an easily removable, washable filter.
- F. Coil:
1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.
 2. The tubing shall have inner grooves for high efficiency heat exchange.
 3. All tube joints shall be brazed with phos-copper or silver alloy.
 4. The coils shall be pressure tested at the factory.
 5. A condensate pan and drain shall be provided under the coil.
 6. Both refrigerant lines to the PKA indoor units shall be insulated.
- G. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.
 2. The system shall be capable of satisfactory operation within voltage limits of 187-228 volts (208V/60Hz) or 207-253 volts (230V/60Hz)
- H. Controls:
1. This unit shall use controls provided by Mitsubishi Electric Cooling & Heating to perform functions necessary to operate the system. Please refer to Part 4 of this guide specification for details on controllers and other control options.
 2. The unit shall be able to control external backup heat.
 3. The unit shall have a factory built in receiver for wireless remote control
 4. Indoor unit shall compensate for the higher temperature sensed by the return air sensor compared to the temperature at level of the occupant when in HEAT mode. Disabling of compensation shall be possible for individual units to accommodate instances when compensation is not required.
 5. Control board shall include contacts for control of external heat source. External heat may be energized as second stage with 1.8°F – 9.0°F adjustable deadband from set point.
 6. Indoor unit shall include no less than four (4) digital inputs capable of being used for customizable control strategies.
 7. Indoor unit shall include no less than three (3) digital outputs capable of being used for customizable control strategies.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install unit's level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.
- E. Prepare test and inspection reports.

END OF SECTION 23 81 27

SECTION 23 82 39 – ELECTRIC UNIT HEATERS

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 wall heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include details of anchorages and attachments to structure and to supported equipment.
 - 4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 5. Wiring Diagrams: Power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wall and ceiling unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Trane.
 - 2. Markel Products; TPI Corporation.

3. Or approved equal.

2.2 DESCRIPTION

- A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

- A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
- B. Finish: Baked enamel over baked-on primer with manufacturer's standard color, applied to factory-assembled and -tested wall heaters before shipping.
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

- A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

- A. Fan: Aluminum propeller directly connected to motor.
- B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

- A. Controls: Unit-mounted thermostat.
- B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch].

2.7 CAPACITIES AND CHARACTERISTICS

- A. Capacities shall be as scheduled on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive wall unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall unit heaters to comply with NFPA 90A.
- B. Install wall ceiling unit heaters level and plumb.

END OF SECTION 23 82 39

SECTION 23 90 20 – TEMPERATURE CONTROLS

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. Electric temperature control system by the air conditioning equipment manufacturer, to be installed by the mechanical contractor.
2. Float Switches.
3. Motorized Dampers.
4. Exhaust Fans.
5. Control Wiring.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. General Requirements.
2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.

PART 2 - PRODUCTS

2.1 FLOAT SWITCH

- A. Provide float switch to emergency drain pan of each AHU. Switch shall be interlocked with AHU to de-energize the unit when the water level in the pan rises above a set level. Float switch shall meet UL 508 requirements.

2.2 MOTORIZED DAMPERS

- A. O.A. motorized dampers shall be interlocked with A/C units in respective mechanical rooms to open when any A/C unit is "on" and closed when all A/C units are "off". Provide all necessary relays, switches, transformers, etc. as required.

- B. Motorized dampers shall be furnished and set in place by contractor installing the ductwork.
- C. Damper actuators shall be 120/1/60 electric actuators specifically selected for damper manufacturer's requirements. Controls contractor shall furnish and install actuators. Coordinate all work with contractor installing dampers.
- D. ***** O.A. motorized dampers shall be interlocked with their respective unit in respective mechanical room to open when the A/C unit's compressor or heating strip is energized(On), and shall close when the unit's compressor and heating strip is de-energized(Off). Provide all necessary relays, switches, transformers, etc. as required.
- E. Motorized dampers shall be furnished and set in place by contractor installing the ductwork.
- F. Damper actuators shall be 120/1/60 electric actuators specifically selected for damper manufacturer's requirements. Controls contractor shall furnish and install actuators. Coordinate all work with contractor installing dampers

2.3 EXHAUST FAN SEQUENCE OF OPERATION

- A. EXHAUST FAN (KEF-1)
 - 1. (Kitchen Hood) Provide "on-off" switch on wall as indicated on the Plans.
- B. EXHAUST FAN (EF-1-5)
 - 1. (Restrooms) Provide interlock wiring with lights. Fan shall be on when lights are "on" and off when lights are "off". Solid state speed control switch mounted in fan housing shall be used for balancing air flow.

2.4 CONTROL WIRING

- A. All wiring required in the control systems, including electrical connections for the thermostats, firestats, smoke detectors, exhaust fans and all interlocking motor control wiring shall be furnished and installed by Mechanical Contractor.
- B. All wiring shall be in conduit and in accordance with the National Electrical Code (N.E.C.).
- C. All control wiring located outdoors shall be installed in rigid or intermediate metal conduit.
- D. All control wiring located indoors where an accessible ceiling is not available shall be installed in E.M.T. conduit.
- E. All control wiring located above accessible ceilings shall be N.E.C. approved cable. All control wiring located above accessible ceilings used as air plenums shall be N.E.C. approved "plenum cable".
- F. All conductors shall be copper. Conductors used for power circuits shall be #12 TW minimum. Conductors used for control circuits shall be #18 TW (single strand) minimum. Conductors used for sensor circuits shall be #18 TW (single strand) minimum. Control wiring for DX equipment thermostats shall be 10 conductor cables.

PART 3 - EXECUTION

3.1 EXAMINATION

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

END OF SECTION 23 90 20

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
1. Supporting devices for electrical components.
 2. Electricity-metering components.
 3. Concrete equipment bases.
 4. Touchup painting.



1.2 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. 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. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

- B. 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.
- C. Coordinate electrical service connections with buildings and grounds.
- D. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- E. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.
- F. Coordinate connecting to all equipment with equipment provider. This includes mechanical, plumbing, owner provided and contractor provided equipment. Contractor to refer to equipment installation documents prior to any rough-in.
- G. Contractor to coordinate with door hardware provider, architect and owner prior to installation of any devices associated with doors to verify door operational requirement, placement of proximity readers, motion sensors, door switches, fire alarm control, magnetic locks, hold open devices, etc..
- H. Contractor to coordinate with architectural millwork shop drawings prior to rough-in for locations of under counter lighting to be installed in and around millwork. No receptacles shall be installed in an enclosed cabinet unless noted on the drawings. Outlets for refrigerators, microwaves, etc. shall be installed in the space identified on the millwork shop drawings.
- I. Contractor shall not penetrate any stair wall assemble with conduit, boxes, cabling and the like, except for items that serve the stairwell.
- J. The contractor shall label the main service disconnecting means with the maximum available fault current shall be listed on the device to meet the requirements of NFPA 70:110.24. The labeling shall be engraved plastic. The maximum available fault current shall be obtained from the electrical utility for the secondary side of the utility transformer.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. 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.

- D. 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.
- E. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- F. Expansion Anchors: Carbon-steel wedge or sleeve type.
- G. Toggle Bolts: All-steel springhead type.
- H. Powder-Driven Threaded Studs: Heat-treated steel.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY CONTRACTOR

- A. Meter: Contractor shall provide metering per the local utility. Contractor shall provide all necessary enclosures, meter cans, etc. per the local utility requirements including any fees associated with the service.

2.3 CONCRETE BASES

- A. Concrete: 3000-psi (20.7-MPa), 28-day compressive strength as specified

2.4 TOUCH-UP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.
- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

- D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. 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.

3.3 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. 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.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. 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.
- H. 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.
- I. Simultaneously install vertical conductor supports with conductors.
- J. 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.

- K. 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.
- L. 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.
- M. 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:
 - 1. Wood: Fasten with wood screws.
 - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
 - 3. New Concrete: Concrete inserts with machine screws and bolts.
 - 4. Existing Concrete: Expansion bolts.
 - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
 - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
 - a. Field Welding: Comply with AWS D1.1.
 - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
 - 8. Light Steel: Sheet-metal screws.
 - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 FIRESTOPPING AND FIRE RATED WALLS/CEILINGS/FLOORS

- A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.5 CONCRETE BASES

- A. Provide a concrete base for all floor mounted equipment. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi

(20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Section "Cast-in-Place Concrete."

3.6 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.7 REFINISHING AND TOUCH-UP PAINTING

- A. Refinish and touch up paint.
 - 1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
 - 2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
 - 3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 00

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70- Latest edition or edition enforced by state and local code authority.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.
- B. Conductor Material: Copper; stranded conductor or solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
- C. Conductor Insulation Types: Type THHN-THWN.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspace: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, including in Crawlspace: Type THHN-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway or MC Cable.
- G. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.
- H. Fire Alarm Cabling: Plenum rated in plenum areas, exposed above accessible ceilings and in conduit when concealed in finished walls, unaccessible ceilings. Secured per NFPA 70-760.
- I. Low Voltage Cabling: Plenum rated in plenum areas, exposed above accessible ceilings and in conduit when concealed in finished walls, unaccessible ceilings. Secured per NFPA 70-760.
- J. Single Phase Circuits: Provide a dedicated neutral. Sharing of neutrals is not allowed.

3.2 INSTALLATION

- A. Conceal cables in conduit in finished walls, unaccessible ceilings, and floors.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Support cables according to Section "Basic Electrical Materials and Methods."
- E. Identify and color-code conductors and cables according to Section "Electrical Identification."

- F. Use #10 AWG conductors for 20 amperage 120 circuits when the circuit conductors are longer than 75 feet. Use #10 AWG conductors for 20 amperage 277 circuits when the circuit conductors are longer than 200 feet.

3.3 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
 - 1. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.
 - 1. Underground grounding.

1.3 QUALITY ASSURANCE

- A. 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
 2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.
- D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches by 24" minimum in cross section, unless otherwise indicated; with insulators.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- C. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus on insulated spacers 1 inch, minimum, from wall 6 inches above finished floor, unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, down to specified height above floor, and connect to horizontal bus.
- D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.

3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
 10. X-ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in

raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
 3. Install ground access well with cover for each ground rod (mounted flush with finished grade).
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without 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.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 3. Prepare dimensioned drawings locating each test well, 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.
- B. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity 500 kVA and less: 10 ohms.
 2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 4. Manhole Grounds: 10 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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 the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Division 26 Section "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
 - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.
- C. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.

- b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
-
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Toggle Bolts: All-steel springhead type.
 7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps / single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT IMC RMC EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. Related Sections include the following:
 - 1. Refer to architectural for firestopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
 - 2. "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
 - 3. "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. FMC: Flexible metal conduit.
- D. IMC: Intermediate metal conduit.
- E. LFMC: Liquidtight flexible metal conduit.
- F. LFNC: Liquidtight flexible nonmetallic conduit.
- G. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

- A. Product Data: For surface raceways, floor boxes, and cabinets.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Comply with NFPA 70-Latest edition or edition enforced by state and local code authority.

1.6 COORDINATION

- A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 METAL WIREWAYS

- A. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 or 3R.
- B. 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.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- D. Wireway Covers: Hinged type.
- E. Finish: Manufacturer's standard enamel finish.

2.2 NONMETALLIC WIREWAYS

- A. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- C. 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.

- D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.3 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating and two coats of paint. Color by Architect.
- B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Floor Boxes: Cast metal, fully adjustable, rectangular with four separate wiring compartments for power outlets, voice and data outlets, and/or AV devices as indicated on the drawing. Wiremold RFB4 Series, T&B 665 Series or approved equal. Covers shall be UL Listed to U.S. and Canadian safety standards for tile, carpet, wood, bare concrete and terrazzo floors. Covers shall be selected by the architect and shall be of Nickel, Brass, Black, Gray or Bronze.
- B. Poke Thru Floor Boxes: Two hour rated poke thru floor unit with capabilities of two duplex power receptacles, data and AV devices. Provide power, data and phone outlets indicated on drawing. Wiremold Evolution Series 6AT or prior approved equal. Covers shall be selected by the architect and shall be of Nickel, Brass, Black, Gray or Bronze. Poke thru floor boxes are to be utilized on upper floors unless noted otherwise. There must be accessibility in the space below the poke thru box.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- F. 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.
- G. Exterior Outlet Lock Box: Cast aluminum with self closing door with lock. All units shall be keyed alike. 16 gauge steel housing. Unit for Interior and Exterior installation. Cole: TL-310 or equivalent.

- H. In grade enclosures, boxes and covers are required to conform to all test provisions of the most current ANSI/SCTE 77 "Specification For Underground Enclosure Integrity" for Tier 22 applications. When multiple "Tiers" are specified the boxes must physically accommodate and structurally support compatible covers while possessing the highest Tier rating. All covers are required to have the Tier level rating embossed on the surface. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box & cover) are manufactured using matched surface tooling. Independent third party verification or test reports stamped by a registered Professional Engineer certifying that all test provisions of this specification have been met are required with each submittal. Cover to labeled per use of box, ie "Electrical, Communications, etc". Communications pull boxes shall be a minimum of 24" w x 36" l x 36" d.

2.5 FACTORY FINISHES

- A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

2.6 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. Aluminum Rigid Conduit: ANSI C80.5.
- C. IMC: ANSI C80.6.
- D. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
- E. Plastic Coated IMC and Fittings: NEMA RN 1.
- F. EMT and Fittings: ANSI C 80.3.
- G. EMT and Fittings: ANSI C80.3.
- H. FMC: Aluminum
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 4.

B. Indoors:

1. Exposed: EMT in non finished areas. Surface metal raceway in existing finished unaccessible areas unless noted otherwise.
2. Concealed: EMT. MC Cable allowed for concealed branch circuits.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
4. Damp or Wet Locations above Ground: Rigid steel conduit.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
 - a. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size (DN 21) below grade and 1/2 inch trade size above grade.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

E. Contractor to provide metal raceway in Patient Care Areas per 517.13. Raceway shall be installed as a redundant ground. Raceway shall be a considered a ground.

3.2 INSTALLATION

A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

- E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.
- F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
 - 1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.
- H. Raceways Embedded in Slabs: Install in middle 1/3 of slab thickness where practical and leave at least 2 inches (50 mm) of concrete cover. Conduits larger than 1" shall not be installed in the slab.
 - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
 - 2. Space raceways laterally to prevent voids in concrete.
 - 3. Run conduit larger than 1-inch trade size (DN 27) parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
- I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.
 - 1. Run parallel or banked raceways together on common supports.
 - 2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- J. Join raceways with fittings designed and approved for that purpose and make joints tight.
 - 1. Use insulating bushings to protect conductors.
- K. Tighten set screws of threadless fittings with suitable tools.
- L. Terminations:
 - 1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.
 - 2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

- M. Install pull wires in empty raceways. Use polypropylene 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 pull wire.
- N. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.
- O. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.
- P. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.
- Q. Set floor boxes level and flush with finished floor surface.
- R. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

- A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

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 the following:
 - 1. Identification for conductors and communication and control cable.
 - 2. Warning labels and signs.
 - 3. Instruction signs.
 - 4. Equipment identification labels.
 - 5. Miscellaneous identification products.

1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.

1.5 COORDINATION

- A. 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 and standards. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- D. Warning label and sign shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.3 INSTRUCTION SIGNS

- A. 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.
 - 1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
 1. Minimum Width: 3/16 inch.
 2. Tensile Strength: 50 lb, minimum.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
 1. Exterior Concrete Unit Masonry:
 - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a block filler.
 - 1) Block Filler: Concrete unit masonry block filler.
 - 2) Finish Coats: Exterior semigloss acrylic enamel.
 2. Exterior Ferrous Metal:
 - a. Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Exterior ferrous-metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 3. Exterior Zinc-Coated Metal (except Raceways):
 - 1) Primer: Exterior zinc-coated metal primer.
 - 2) Finish Coats: Exterior semigloss alkyd enamel.
 4. Interior Ferrous Metal:
 - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Interior ferrous-metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
 5. Interior Zinc-Coated Metal (except Raceways):
 - a. Semigloss Acrylic-Enamel Finish: Two finish coat(s) over a primer.
 - 1) Primer: Interior zinc-coated metal primer.
 - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Branch-Circuit Conductor Identification: 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.
- B. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- D. 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.
 - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
 - 2. 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.
- E. Instruction Signs:
 - 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.
 - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control

stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
 - a. Panelboards, electrical cabinets, and enclosures.
 - b. Access doors and panels for concealed electrical items.
 - c. Electrical switchgear and switchboards.
 - d. Transformers.
 - e. Emergency system boxes and enclosures.
 - f. Receptacles with panel and circuit numbers.
 - g. Disconnect switches.
 - h. Enclosed circuit breakers.
 - i. Power transfer equipment.
 - j. Contactors.

3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service feeder branch-circuit service, feeder, and branch-circuit conductors.
 1. Color shall be factory applied factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.

- c. Phase C: Blue.
3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
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.

END OF SECTION 26 05 53

SECTION 26 09 23 – LIGHTING CONTROL DEVICES

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 the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Lighting contactors.
 - 5. Emergency shunt relays.
- B. Related Sections include the following:
 - 1. Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. PIR: Passive infrared.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
 - 1. Interconnection diagrams showing field-installed wiring.
 - 2. Layout of all devices on floor plan. Work to be done in electronic form such as AutoCAD. Manufacturer shall provide a design to accommodate proper coverage throughout.
- C. Field quality-control test reports.

- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. 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.
- B. Color of all wall mounted devices of this section shall match color of devices and plates of the wiring device section.

1.6 COORDINATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Grasslin Controls Corporation; a GE Industrial Systems Company.
 2. Intermatic, Inc.
 3. Leviton Mfg. Company Inc.
 4. Lightolier Controls; a Genlyte Company.
 5. Lithonia Lighting; Acuity Lighting Group, Inc.
 6. Paragon Electric Co.; Invensys Climate Controls.
 7. Square D; Schneider Electric.
 8. TORK.
 9. Touch-Plate, Inc.
 10. Watt Stopper (The).
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
 1. Contact Configuration: DPDT.
 2. Contact Rating: 30-A inductive or resistive, 240-V ac.
 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
 4. Programs: 2 channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.

5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
6. Astronomic Time: All channels.
7. Battery Backup: For schedules and time clock.

C. Electromechanical-Dial Time Switches: Type complying with UL 917.

1. Contact Configuration: DPDT.
2. Contact Rating: 30-A inductive or resistive, 240-V ac.
3. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
4. Astronomic time dial.
5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
6. Skip-a-day mode.
7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Area Lighting Research, Inc.; Tyco Electronics.
2. Grasslin Controls Corporation; a GE Industrial Systems Company.
3. Intermatic, Inc.
4. Lithonia Lighting; Acuity Lighting Group, Inc.
5. GreenGate.
6. Paragon Electric Co.; Invensys Climate Controls.
7. Square D; Schneider Electric.
8. TORK.
9. Touch-Plate, Inc.
10. Watt Stopper (The).

B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: 15-second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

- C. Description: Solid state, with DPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range.
 2. Time Delay: 30-second minimum, to prevent false operation.
 3. Lightning Arrester: Air-gap type.
 4. Mounting: Twist lock complying with IEEE C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. GreenGate.
 5. Sensor Switch, Inc.
 6. Watt Stopper (The).
- B. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 6. Bypass Switch: Override the on function in case of sensor failure.
 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.
 8. Wall mounted devices color shall match color selected for switches and receptacles. Refer to other sections in specifications.
 9. Meet Nema WD 7-2011 requirements.

- C. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.
- D. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).
- E. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
- F. System and Design Requirements:
1. Products supplied shall be from a single manufacturer that has been continuously involved in manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.
 2. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.
 3. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

4. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.
5. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits
6. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
7. Meet Nema WD 7-2011 requirements.

2.4 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Allen-Bradley/Rockwell Automation.
 2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
 3. Eaton Electrical Inc.; Cutler-Hammer Products.
 4. GE Industrial Systems; Total Lighting Control.
 5. Grasslin Controls Corporation; a GE Industrial Systems Company.
 6. Hubbell Lighting.
 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 8. MicroLite Lighting Control Systems.
 9. Square D; Schneider Electric.
 10. TORK.
 11. Touch-Plate, Inc.
 12. Watt Stopper (The).
 13. Siemens
- B. Description: Electrically operated and mechanically held, combination type with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.5 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The drawings indicate only the rooms which are to be provided with sensors. The contractor shall provide sensors as required to properly and completely cover the respective room.
- B. It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.
- C. It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.
- D. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein. Drawings may indicate the room in which occupancy sensor control is required. The contractor and manufacture shall provide a device to provide proper coverage of the area.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be **1/2 inch (13 mm)**.

- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
 - 2. Identify circuits or luminaries controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.
- C. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 26 09 23

SECTION 26 24 16 – PANELBOARDS

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. Distribution panelboards.
 - 2. Lighting and appliance branch-circuit panelboards.
 - 3. Load centers.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, accessories, and components indicated.
 - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.

3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Key interlock scheme drawing and sequence of operations.
10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Keys: Two spares for each type of panelboard cabinet lock.
 2. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards 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.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Architect's written permission.
3. Comply with NFPA 70E.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Flush and Surface-mounted, dead-front cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.
 - 2. Height: 84 inches maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
 - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 - 6. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
- G. Incoming Mains:
 - 1. Location: Convertible between top and bottom.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

- H. Phase, Neutral, and Ground Buses:
1. Material: Hard-drawn copper, 98 percent conductivity.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
 5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
 6. Split Bus: Vertical buses divided into individual vertical sections.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Terminations shall allow use of 75 deg C rated conductors without derating.
 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
 8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
- J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 20 percent.

- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
 - 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
 - 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

2.2 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: As per schedule
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on electronic circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: As indicated on the schedules.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.
- F. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.
 - 1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company; GE Energy Management - Electrical Distribution.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; by Schneider Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long and short time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Subfeed Circuit Breakers: Vertically mounted.
 9. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Breaker handle indicates tripped status.
 - c. UL listed for reverse connection without restrictive line or load ratings.
 - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Communication Capability: Circuit-breaker-mounted communication module with functions and features compatible with power monitoring and control system specified in Section 26 09 13 "Electrical Power Monitoring and Control."
 - h. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - i. Auxiliary Contacts: Two, SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
 - j. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
 - k. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
 - l. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
 - m. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 26 28 13 "Fuses."
 2. Fused Switch Features and Accessories:
 - a. Standard ampere ratings and number of poles.
 - b. Mechanical cover interlock with a manual interlock override, to prevent the opening of the cover when the switch is in the on position. The interlock shall prevent the switch from being turned on with the cover open. The operating handle shall have lock-off means with provisions for three padlocks.

2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Directory card inside panelboard door, mounted in metal frame with transparent protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.
- D. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.6 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NECA 407.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. 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, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NECA 407.
- D. Equipment Mounting:
 - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
 - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
 - 3. Comply with requirements for seismic control devices specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- I. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- J. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- K. Install filler plates in unused spaces.
- L. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- M. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- N. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 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.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.

- b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
- c. Instruments and Equipment:
 - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73.16 "Coordination Studies."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

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. Single and duplex receptacles, ground-fault circuit interrupters and isolated-ground receptacles.
 - 2. Single- and double-pole snap switches.
 - 3. Device wall plates.
 - 4. Pin and sleeve connectors and receptacles.
 - 5. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. PVC: Polyvinyl chloride.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Receptacles, switches, plates, floor outlets, poke through assemblies, service poles and multioutlet assemblies.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70 latest edition or edition enforced by state or local code authority.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Outlets - Duplex:
 - a. Hubbell Incorporated- HBL 5362.
 - b. Leviton Mfg. Company Inc.-5362.
 - c. Pass & Seymour-CRB5362.
 - d. Pass & Seymour -PT5362A (Plug Tail Device).
 - 2. Switches-Single Pole:
 - a. Hubbell- HBL 1221.
 - b. Pass & Seymour - PS20AC1.
 - c. Leviton Mfg. Company, Inc.- 1221-1
 - 3. Switches-Three Pole:
 - a. Hubbell- HBL1223
 - b. Leviton Mfg. Company, Inc.-1223-2.
 - c. Pass & Seymour-PS20AC3.
 - 4. Dimmer Switches Line Voltage:
 - a. Lutron Nova T
 - b. Pass & Seymour CD2000

* Dimmer must be compatible with Ballast or LED Driver.
 - 5. Dimmer Switches 0-10V:
 - a. Synergy ISD
 - b. Cooper SF10P

* Dimmer must be compatible with Ballast or LED Driver.
 - 6. GFI Receptacles: Weather Resistant:
 - a. Hubbell Incorporated- BR20WR
 - b. Leviton Mfg. Company Inc.-WBR20

- c. Pass & Seymour- WR5362.
- 7. GFI Receptacles: Weather Resistant and Tamper Resistant:
 - a. Hubbell Incorporated- BR2WRTR.
 - b. Leviton Mfg. Company Inc.-TWR20
 - c. Pass & Seymour- WR20TR.
- 8. Receptacles: Tamper Resistant:
 - a. Hubbell Incorporated- BR20TR.
 - b. Leviton Mfg. Company Inc.-TWR20
 - c. Pass & Seymour- TR5362.

2.2 RECEPTACLES

- A. Straight-Blade-Type Receptacles: Comply with UL 498, 20 amp.
- B. Straight-Blade and Locking Receptacles: Heavy-Duty grade 20 amp.
- C. GFCI Receptacles: Straight blade, feed-through type, Heavy-Duty grade, with 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.

2.3 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 - 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. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.4 SWITCHES

- A. Single- and Double-Pole Switches: Comply with UL 20, 20 amp.
- B. Snap Switches: Heavy-Duty grade, quiet type 20 amp, 120/277 volt.
- C. Live Voltage Dimmer: 120V, 2000 watt, slide to-off. Dimmer must be compatible with ballast or driver.
- D. 0-10V Dimmer: 120/277VAC, capable of three way, max wattage 1200 w 120VAC, 150000 277 VAC, Dimmer must be compatible with ballast or driver. 100% to 1% continuous.

2.5 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: **As selected by Architect.**
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

2.6 POKE-THROUGH ASSEMBLIES

- A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multi-channelled, through-floor raceway/firestop unit and detachable matching floor service outlet assembly.
 - 1. Service Outlet Assembly: Recessed type with three (3) compartments that allow for up to three (3) duplex receptacles and/or 12 communication ports and/or 10 AV devices.
 - 2. Size: Selected to fit nominal 6-inch (100-mm) cored holes in floor and matched to floor thickness.
 - 3. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
 - 4. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors; and a minimum of four, 4-pair, Category 6 voice and data communication cables.

2.7 FINISHES

- A. Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70.2.
 - 2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies level, plumb, and square with building lines.
- B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- C. Remove wall plates and protect devices and assemblies during painting.

- D. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- E. Install weather resistant receptacles in damp and wet locations per N.E.C. requirements.
- F. Install tamper resistant receptacles in homes, apartments, hotel rooms and daycares per N.E.C. requirements.

3.2 CONNECTIONS

- A. Ground equipment according to Division 16 Section "Grounding and Bonding."
- B. Connect wiring according to Division 16 Section "Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
 - 2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.
- B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 13 – FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Cartridge fuses rated 600 V and less for use in switches.

1.3 SUBMITTALS

- A. Product Data: Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Fuse size for elevator feeders and elevator disconnect switches.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ferraz Shawmut, Inc.
 - 2. Little Fuse.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.
- B. End Caps: End caps shall be capable of being tested if fuse is blown.
- C. Indicating Feature: Fuse shall have an indicating feature which clearly indicates when fuse is blown.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Motor Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 28 13

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:
 - 1. Feeder and branch-circuit protection.
 - 2. Motor and equipment disconnecting means.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. RMS: Root mean square.
- C. SPDT: Single pole, double throw.

1.4 SUBMITTALS

- A. Product Data: For each type of switch, circuit breaker, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each switch and circuit breaker.
 - 1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
 - a. Enclosure types and details for types other than NEMA 250, Type 1.
 - b. Current and voltage ratings.
 - c. Short-circuit current rating.
 - d. UL listing for series rating of installed devices.

- e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 2. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
 - 3. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.
- 1.5 QUALITY ASSURANCE
- A. 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.
 - B. Comply with NFPA 70- Latest edition or edition enforced by state and local code authority.
 - C. 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.
- 1.6 COORDINATION
- A. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Fusible Switches:
 - a. Eaton Corp.; Cutler-Hammer Products, K-Series.
 - b. General Electric Co.; Electrical Distribution & Control Division, TH.
 - c. Siemens Energy & Automation, Inc., VBII.
 - d. Square D Co, 3110.

2.2 ENCLOSED SWITCHES

- A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

- B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, with clips to accommodate specified fuses, lockable handle with two padlocks, and interlocked with cover in closed position.

2.3 ENCLOSURES

- A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.
 - 1. Outdoor Locations: NEMA 250, Type 3R.
 - 2. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.4 FACTORY FINISHES

- A. Manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in "Basic Electrical Materials and Methods."
- B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.
- C. If the disconnect or enclosed circuit breaker is used as a Main Service Disconnect then the maximum available fault current shall be listed on the device to meet the requirements of NFPA 70:110.24. The labeling shall be engraved plastic. The maximum available fault current shall be obtained from the electrical utility for the secondary side of the utility transformer.

3.3 CONNECTIONS

- A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main electrical ground bus.

- B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.
- D. Maintain all necessary clearances per NFPA-70.

3.4 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 - 1. Test insulation resistance for each enclosed switch, circuit breaker, component, and control circuit.
 - 2. Test continuity of each line- and load-side circuit.

3.5 ADJUSTING

- A. Set field-adjustable switches and circuit-breaker trip ranges.

3.6 CLEANING

- A. On completion of installation, inspect interior and exterior of enclosures. 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.

END OF SECTION 26 28 16

SECTION 26 43 13 – SURGE PROTECTION DEVICE FOR SERVICE ENTRANCE AND BRANCH
PANELS

PART 1 - GENERAL

1.1 DESCRIPTION/SCOPE

- A. The Surge Protection Device (SPD) covered under this section includes all service entrance type surge protection devices suitable for use as Type 1 or Type 2 devices per UL1449 4th Edition, applied to the line or load side of the utility feed inside the facility.
- B. A SPD located at Service Entrance and Distribution and Branch Panels, Switchgear, Motor Control Centers, and Switchboard assemblies as indicated on the drawings.
- C. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

- A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
 - 1. UL 1449 4th Edition.
 - 2. UL 1283.
 - 3. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
 - 4. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
 - 5. UL96A
 - 6. IEEE 1100 Emerald Book.
 - 7. National Fire Protection Association (NFPA 70: National Electrical Code).

1.3 SUBMITTALS/QUALITY ASSURANCE – SUBMIT THE FOLLOWING:

- A. Package must include shop drawings complete with all technical information, unit dimensions, detailed installation instructions, maintenance manual, recommended replacement parts list and wiring configuration.
- B. Copies of Manufacturer's catalog data, technical information and specifications on equipment proposed for use.

- C. Copies of documentation stating that the Surge Protection Device is listed by UL to UL1449 4th Edition, category code VZCA.
- D. Copies of actual let through voltage data in the form of oscillograph results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
- E. Copies of Noise Rejection testing as outlined in NEMA LS1-1992 (R2000) Section 3.11. Noise rejection is to be measured between 50 kHz and 100 MHz verifying the devices noise attenuation. Must show multiple attenuation levels over a range of frequencies.
- F. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on a per mode basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.
- G. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURER FOR *TYPE C SPD's for Service Entrance Application:*

- A. Current Technology – Transguard3 or TG3 Series **150kA** per mode surge rating or ASCO 560 series.
- B. Approved equivalent. Submission package must be received by engineer 2 weeks prior to bid date shall fully comply with all performance characteristics included in this specification.

2.2 MANUFACTURED UNITS/ ELECTRICAL REQUIREMENTS

- A. Refer to drawing for operating voltage, configuration and surge current capacity per mode for each location, or you may list locations and information here.
- B. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449 4th Edition, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% operational voltage test, section 38 in UL1449 will not be accepted.
- C. Unit shall have no more than 10% deterioration or degradation of the UL1449 4th Edition Voltage Protection Rating (VPR) when exposed to a minimum of 5,000 repeated category C3 (20kV/10kA) surges. The SPD manufacturer must provide a test report validating the repetitive surge test was performed.

- D. Protection Modes UL1449 4th Edition VPR(6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449 4th Edition section 37.6:

System Voltage	Mode	MCOV	B3 Ringwave 6kV, 500A	C3 Comb. Wave 20kV, 10kA	UL 1449 Third Edition VPR Rating
120/240, 120/208	L-N	150	490	980	700
	L-G	150	570	980	700
	N-G	150	640	1170	700
	L-L	300	500	1600	1200
277/480	L-N	320	450	1420	1200
	L-G	320	540	1540	1200
	N-G	320	570	1600	1000
	L-L	552	530	2600	2000

- E. Electrical Noise Filter- each unit shall include a high performance EMI/RFI noise rejection filter with a maximum attenuation of 54dB per MIL-STD-220B.
1. SPD shall include an EMI/RFI noise rejection filter for all L-N modes as well as a removable filter in the N-G mode.
- F. Integral Disconnect Switch (IF REQUIRED)
1. The device shall have an optional NEMA compliant safety interlocked integral disconnect switch with an externally mounted metal manual operator.
 2. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption to the facility's distribution system.
 3. The switch shall be rated for 600Vac.
 4. The SPD device shall be tested to UL1449 4th Edition listed with the integral disconnect switch and the UL1449 VPR ratings shall be provided.
 5. The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.
 6. The line side of the integral disconnect shall be blocked off so that when the SPD is opened there is no direct access to the voltage present on the line side of the disconnect.
- G. The UL1449 Voltage Protective Rating (VPR) shall be permanently affixed to the SPD unit.
- H. The UL1449 Nominal Discharge Surge Current Rating shall be 20Ka
- I. The SCCR rating of the SPD shall be 200kAIC without the need for upstream over current protection.

- J. The SPD shall be listed as Type1 SPD, suitable for use in Type1 or Type2 applications.
- K. The SPD shall have the following monitoring options.
 - 1. Time Date stamp, duration and magnitude for the following power quality events (sags, swells, surges, dropouts, outages, THD, frequency, Volts RMS per phase)
 - 2. SPD monitoring shall track surge protection and display it as a percentage
 - 3. SPD shall provide a surge counter with three categories to be defined as
Low Level surge (100A-500A) Medium Level surge (500A-3,000A) High Level surge (>3,000A)
 - 4. Remote communications via ModBus or Ethernet

2.3 APPROVED MANUFACTURER FOR **TYPE B SPD's for Branch Panel Application:**

- A. Current Technology – Transguard3 or TG3 Series 50 kA per mode surge rating or ASCO 560 series.
- B. Approved equivalent. Submission package must be received by engineer 2 weeks prior to bid date shall fully comply with all performance characteristics included in this specification.

2.4 MANUFACTURED UNITS/ ELECTRICAL REQUIREMENTS

- A. Refer to drawing for operating voltage, configuration and surge current capacity per mode for each location, or you may list locations and information here.
- B. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449 4th Edition, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% operational voltage test, section 38 in UL1449 will not be accepted.
- C. Unit shall have no more than 10% deterioration or degradation of the UL1449 4th Edition Voltage Protection Rating (VPR) when exposed to a minimum of 5,000 repeated category C3 (20kV/10kA) surges. The SPD manufacturer must provide a test report validating the repetitive surge test was performed.
- D. Protection Modes UL1449 4th Edition VPR(6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449 4th Edition section 37.6:

System Voltage	Mode	MCOV	B3 Ringwave 6kV, 500A	C3 Comb. Wave 20kV, 10kA	UL 1449 Third Edition VPR Rating
120/240, 120/208	L-N	150	490	980	700
	L-G	150	570	980	700
	N-G	150	640	1170	700
	L-L	300	500	1600	1200
277/480	L-N	320	450	1420	1200
	L-G	320	540	1540	1200
	N-G	320	570	1600	1000
	L-L	552	530	2600	2000

- E. Electrical Noise Filter- each unit shall include a high performance EMI/RFI noise rejection filter with a maximum attenuation of 54dB per MIL-STD-220B.
1. SPD shall include an EMI/RFI noise rejection filter for all L-N modes as well as a removable filter in the N-G mode.
- F. Integral Disconnect Switch (IF REQUIRED)
1. The device shall have an optional NEMA compliant safety interlocked integral disconnect switch with an externally mounted metal manual operator.
 2. The switch shall disconnect all ungrounded circuit conductors from the distribution system to enable testing and maintenance without interruption to the facility's distribution system.
 3. The switch shall be rated for 600Vac.
 4. The SPD device shall be tested to UL1449 4th Edition listed with the integral disconnect switch and the UL1449 VPR ratings shall be provided.
 5. The integral disconnect switch shall be capable of withstanding, without failure, the published maximum surge current magnitude without failure or damage to the switch.
 6. The line side of the integral disconnect shall be blocked off so that when the SPD is opened there is no direct access to the voltage present on the line side of the disconnect.
- G. The UL1449 Voltage Protective Rating (VPR) shall be permanently affixed to the SPD unit.
- H. The UL1449 Nominal Discharge Surge Current Rating shall be 20kA
- I. The SCCR rating of the SPD shall be 200kAIC without the need for upstream over current protection.
- J. The SPD shall be listed as Type1 SPD, suitable for use in Type1 or Type2 applications.
- K. The SPD shall have the following monitoring options available.
1. Time Date stamp, duration and magnitude for the following power quality events (sags, swells, surges, dropouts, outages, THD, frequency, Volts RMS per phase)
 2. SPD monitoring shall track surge protection and display it as a percentage

3. SPD shall provide a surge counter with three categories to be defined as
Low Level surge (100A-500A) Medium Level surge (500A-3,000A) High Level surge (>3,000A)
4. Remote communications via ModBus or Ethernet

PART 3 - EXECUTION/INSTALLATION

- 3.1 STARTUP - The SPD manufacturer's technician shall perform a system checkout and start-up in the field to assure proper installation, operation and to initiate the warranty of the system. The technician will be required to do the following:
 - A. Verify voltage clamping levels utilizing a diagnostic test kit, comparing factory readings to installed readings.
 - B. Verify N-G connection.
 - C. Record information to a product signature card for each product installed.
- 3.2 Unit may be installed on either the line or load side of the main service disconnect. If installed on the line side unit shall be installed with an integral disconnect. If installed on the load side the unit shall be installed on the largest breaker size available. If installed lead length exceeds 5' installer shall use a low impedance (HPI) cable to reduce the lead lengths effect on the installed performance of the SPD.

PART 4 - PRODUCT WARRANTY

- 4.1 Warranty on defective material and workmanship shall be for 15 years.
- 4.2 Copy of Warranty to be sent with submittal.

END OF SECTION 26 43 13

SECTION 26 51 00 – INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 REFERENCES

- A. ANSI/NFPA 70, National Electrical Code
- B. IEEE C62.41, Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits
- C. FCC 47 CFR Part 15, Federal Code Of Regulation (CFR) testing standard for electronic equipment
- D. IESNA LM-79, Electrical and Photometric Measurements of Solid-State Lighting Products
- E. IESNA LM-80, Approved Method for Measuring Lumen Maintenance of LED Light Sources
- F. UL1598, Standard for Safety of Luminaires
- G. NEMA SSL 3-2010, High-Power White LED Binning for General Illumination

1.3 SUMMARY

- A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

1.4 SUBMITTALS

- A. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:
 - 1. Dimensions of fixtures.
 - 2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.
 - 3. Certified results of laboratory tests for fixtures and lamps for photometric performance.
 - 4. Emergency lighting unit battery and charger.
 - 5. Fluorescent and high-intensity-discharge ballasts.

6. Types of lamps.

- B. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.
 - 1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.
- C. Submit product data on luminaires. Product data to include, but not limited to materials, finishes, approvals, photometric performance, and dimensional information.
- D. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in the front end documents.

1.5 DRAWINGS

- A. The drawings, which constitute a part of these specifications, indicate the general location of the luminaires. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.
- B. Photometric layout shall meet or exceed the criteria of the fixtures indicated on drawings.

1.6 QUALITY ASSURANCE

- A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70- Latest edition or edition enforced by state and local code authority.
- C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.
- D. LED Luminaires
 - 1. Manufactures of LED luminaires shall demonstrate a suitable testing program incorporating high heat, high humidity and thermal shock test regimens to ensure system reliability and to substantiate lifetime claims.
 - 2. The use of IESNA LM-80 data to predict luminaire lifetime is not acceptable.
 - 3. At time of manufacture, electrical and light technical properties shall be recorded for each luminaire. At a minimum, this should include lumen output, CCT, and CRI. Each luminaire shall utilize a unique serial numbering scheme. Technical properties must be made available for a minimum of 5 years after the date of manufacture.
 - 4. Luminaires shall be provided with a 5 year warranty covering, LEDs, drivers, paint and mechanical component.

1.7 COORDINATION

- A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.8 WARRANTY

- A. General Warranty: The contractor shall warranty all work for one year after acceptance of project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in the Fixture schedule on the drawings. Manufacturer shall submit for prior approval where required at least (10) days prior to bid.
- B. Subject to compliance with these specifications, luminaires shall be as manufactured by manufacturer indicated on the drawings or prior approved equivalent.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

- A. Metal Parts: Free from burrs, sharp corners, and edges.
- B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.
- C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

2.3 FLUORESCENT LAMP BALLASTS

- A. General Requirements: Unless otherwise indicated, features include the following:
 - 1. Designed for type and quantity of lamps indicated at full light output.
 - 2. Total Harmonic Distortion Rating: Less than 10 percent.
 - 3. Sound Rating: A.
- B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:

1. Encapsulation: Without voids in potting compound.
 2. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail. Multiple lamp ballasts shall comply with ANSI C 82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.
 3. Operating Frequency: Ballast shall be high frequency electronic type and operate lamps at a frequency between 42 kHz and 52 kHz to avoid interference with infrared devices and eliminate visible flicker.
 4. Ballast shall provide Independent Lamp Operation (ILO) for Programmed Start ballasts allowing remaining lamp(s) to maintain full light output when one or more lamps fail. Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
 5. Ballast shall operate from 60 Hz input source of 120V through 277V or 347V as applicable with sustained variations of +/- 10% (voltage and frequency).
 6. Ballast starting voltage shall be equal to or greater than 550v.
- C. Ballasts for Compact Lamps in Recessed Fixtures: Unless otherwise indicated, additional features include the following:
1. Type: Electronic or electromagnetic, fully encapsulated in potting compound.
 2. Power Factor: 90 percent, minimum.
 3. Operating Frequency: 20 kHz or higher. 42 kHz or higher.
 4. Flicker: Less than 5 percent.
 5. Lamp Current Crest Factor: Less than 1.7.

2.4 EXIT SIGNS

- A. Internally Lighted Signs: As follows:
1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum rated lamp life.

2.5 LAMPS

- A. Fluorescent Color Temperature and Minimum Color-Rendering Index: Refer to drawings.
- B. 4 foot lamps shall be 28 watt, 68,000 rated life 12 hour on with instant start ballast and 90,000 12 hour on with programmable start. Initial lumens 2650, minimum CRI of 82 and a 96% lumen maintenance. Approved lamp is Philips Energy Advantage.
- C. All fluorescent lamps shall be low mercury.

2.6 LED LUMINAIRES

- A. General: Except as otherwise indicated, provide LED luminaires, of types and sizes indicated on fixture schedules.

- B. Material and specifications for each luminaire are as follows:
1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply)
 2. Each luminaire shall be rated for a minimum operational life of 50,000 hours and to LM-70 lumen depreciation standards. This life rating must be conducted 40C ambient temperature.
 3. The rated operating temperature range shall be -30°C to +40°C.
 4. Each luminaire is capable of operating above 100°F [37°C], but not expected to comply with photometric requirements at elevated temperatures.
 5. Photometry must be compliant with IESNA LM-79 and shall be conducted at 25°C ambient temperature.
 6. The individual LEDs shall be constructed such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.
 7. Luminare shall be constructed such that LED modules may be replaced or repaired without replacement of whole luminaire.
 8. Each luminaire shall be listed with Underwriters Laboratory, Inc. under UL1598 for luminaires, or an equivalent standard from a nationally recognized testing laboratory.
- C. Technical Requirements
1. Electrical
 - a. Power Consumption: Maximum power consumption allowed for the luminaire shall be determined by application. The luminaire shall not consume power in the off state.
 - b. Operation Voltage: The luminaire shall operate from a 60 HZ \pm 3 HZ AC line over a voltage ranging from 108 VAC to 305 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
 - c. Power Factor: The luminaire shall have a power factor of 0.90 or greater.
 - d. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent.
 - e. Each Luminaire shall have UL Listed Class II power supplies. Class I power supplies will not be acceptable.
 - f. Operational Performance: The LED circuitry shall prevent visible flicker to the unaided eye over the voltage range specified above.
 - g. RF Interference: LED Drivers must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
 - h. Drivers shall have a Class A sound rating
 2. Thermal Management
 - a. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the expected useful life.
 - b. The LED manufacturer's maximum thermal pad temperature for the expected life shall not be exceeded.
 - c. Thermal management shall be passive by design. The use of fans or other mechanical devices shall not be allowed.

- d. The luminaire shall have a minimum heat sink surface such that LED manufacturer's maximum junction temperature is not exceeded at maximum rated ambient temperature.
- e. The heat sink material shall be aluminum

2.7 FIXTURE SUPPORT COMPONENTS

- A. Comply with "Basic Electrical Materials and Methods," for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
- C. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.
- D. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.8 FINISHES

- A. Fixtures: Manufacturer's standard, unless otherwise indicated.
 - 1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.
 - 2. Metallic Finish: Corrosion resistant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.
- B. Support for Fixtures in or on Grid-Type Suspended Ceilings: Use grid for support.
 - 1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches (150 mm) from fixture corners.
 - 2. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
- C. Suspended Fixture Support: As follows:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.

3.2 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Provide instruments to make and record test results.

C. Tests: As follows:

1. Verify normal operation of each fixture after installation.
2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.
3. Verify normal transfer to emergency source and retransfer to normal.
4. Report results in writing.

D. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

E. Corrosive Fixtures: Replace during warranty period.

3.4 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

END OF SECTION 26 51 00

SECTION 28 31 11 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes fire alarm systems.
- B. Definitions:
1. FACP: Fire alarm control panel.
 2. LED: Light-emitting diode.
 3. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
- C. System Description:
1. Noncoded, Analog addressable system; multiplexed signal transmission dedicated to fire alarm service only.
- D. Performance Requirements:
1. Comply with NFPA 72 latest edition or edition enforced by state or local code authority.
 2. Fire alarm signal initiation shall be by one or more of the following devices:
 - a. Manual stations.
 - b. Heat detectors.
 - c. Smoke detectors.
 - d. Automatic sprinkler system water flow.
 3. Fire alarm signal shall initiate the following actions:
 - a. Alarm notification appliances shall operate continuously and be synchronized as required per code.
 - b. Identify alarm at the FACP and remote annunciators.
 - c. Transmit an alarm signal to the remote alarm receiving station.
 - d. Shut down heating, ventilating, and air-conditioning equipment over 2000 cfm.
 - e. Record events in the system memory.
 4. Supervisory signal initiation shall be by one or more of the following devices or actions:
 - a. Operation of a fire-protection system valve tamper.
 5. System trouble signal initiation shall be by one or more of the following devices or actions:



- a. Open circuits, shorts and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
 - b. Opening, tampering, or removal of alarm-initiating and supervisory signal-initiating devices.
 - c. Loss of primary power at the FACP.
 - d. Ground or a single break in FACP internal circuits.
 - e. Abnormal ac voltage at the FACP.
 - f. A break in standby battery circuitry.
 - g. Failure of battery charging.
 - h. Abnormal position of any switch at the FACP or annunciator.
6. Resetting of other systems:
- a. Resetting of duct detectors shall be from the panel.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:
 1. 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.
 2. Device Address List: Coordinate with final system programming.
 3. System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.
 4. Wiring Diagrams: Power, signal, and control wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Show wiring color code.
 5. Batteries: Size calculations.
 6. CAD drawings with device locations, device ratings, cable routing, cable size/type, etc. indicated on floor plans.
 7. All shop drawings are to be electronic in nature and submitted in PDF form. Paper shop drawings will not be reviewed.
- C. Field quality-control test reports per NFPA 72.
- D. Operation and maintenance data.
- E. Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in "Submittals," make an identical submittal to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Complete all required form. Contractor is responsible for all required fees. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Architect for review.

- F. All drawings shall be done in AutoCAD 14 format or newer. Fire Alarm devices with any notation are to clearly stand out from the floorplan by using a bolder line width contrasting a screened floorplan. Devices and notation are to be proportionally sized to the scale of the drawing. Fire alarm devices only are to be indicated on drawings, drawings are not to be shared with electrical devices or any other discipline.
- G. Documentation:
 - 1. Approval and Acceptance: Provide the "Record of Completion" form according to NFPA 72 to Owner, Architect, and authorities having jurisdiction.
 - 2. Record of Completion Documents: Provide the "Permanent Records" according to NFPA 72 to Owner, Architect, and authorities having jurisdiction. Format of the written sequence of operation shall be the optional input/output matrix.
 - a. Electronic media shall be provided to Architect and authorities having jurisdiction.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project and shall be supervised by a Nicet Level III Supervisor.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS & INSTALLER

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. FACP and Equipment:
 - a. Notifier
- B. Installer: Advanced Systems Alarm Services

2.2 FACP

- A. General Description:
 - 1. Modular, power-limited design with electronic modules, UL 864 listed.
 - 2. Analog addressable control circuits for operation of mechanical equipment.
 - 3. System shall be sized for the number of points indicated plus (20) twenty percent spare.

- B. 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.
 - 1. Annunciator and Display: Liquid-crystal type, two line(s) of 40 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

- C. Circuits:
 - 1. Signaling Line Circuits: NFPA 72, Class B, Style 4.
 - 2. Notification-Appliance Circuits: NFPA 72, Class B, Style Y.
 - 3. Circuits shall be configured with loop isolators.
 - 4. Actuation of alarm notification appliances, annunciation, elevator recall shall occur within 10 seconds after the activation of an initiating device.
 - 5. 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.

- D. Notification-Appliance Circuit: Operation shall sound in a temporal pattern, complying with ANSI S3.41.

- E. 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.

- F. Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.
 - 1. Silencing-switch operation halts alarm operation of notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.
 - 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 - 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

- G. 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.

- H. 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.

- I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signal, supervisory signal and

supervisory and digital alarm communicator transmitter shall be powered by the 24-V dc source.

1. The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.
 2. Power supply shall have a dedicated fused safety switch or circuit breaker for this connection at the service entrance equipment. The switch box or circuit breaker shall have red marking and identify it with "FIRE ALARM SYSTEM POWER." Where a circuit breaker is the disconnecting means, an approved breaker locking device shall be installed.
 3. Provide surge protection on all 120 volt power serving fire alarm equipment.
- J. Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.
1. Battery and Charger Capacity: Comply with NFPA 72.
 2. Provide surge protectors on all circuits.
- K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum 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 PULL STATION

- A. 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.
1. Double-action mechanism requiring two 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. Station Reset: Key- or wrench-operated switch.

2.4 SYSTEM SMOKE DETECTORS

- A. General Description:
1. UL 268 listed, operating at 24-V dc, nominal.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 3. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
 4. Multi-criteria with minimum of thermal and photoelectric.

- B. Multi Criteria Detectors:
 - 1. Minimum of photoelectric and heat.
 - 2. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 3. Photoelectric Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
 - 4. Thermal detection.

- C. Photoelectric Smoke Detectors:
 - 1. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - 2. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.

- D. Duct Smoke Detectors:
 - 1. Photoelectric Smoke Detectors:
 - a. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - b. Detector Sensitivity: Between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) smoke obscuration when tested according to UL 268A.
 - 2. UL 268A listed, operating at 24-V dc, nominal.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 - 4. 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.
 - 5. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type. Indicating detector has operated and power-on status.
 - 7. Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.
 - 8. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.5 HEAT DETECTORS

- A. General: UL 521 listed.

- B. 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.
 - 1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F (88 deg C).
 - 1. Mounting: Plug-in base, interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 NOTIFICATION APPLIANCES

- A. Description: Equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.
- B. Horns: Electric-vibrating-polarized type, 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.
- C. Visible Alarm Devices: 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.
 - 1. Rated Light Output: Candela indicated on drawings.
 - 2. Strobe Leads: Factory connected to screw terminals.
 - 3. Where multiple visual notification appliances can be seen from any location, circuitry shall be incorporated for the synchronization of flash rate.
 - 4. Adjustable Strobes-Field selectable from 15cd, 30cd, 75cd, 110cd.

2.7 SPRINKLER SYSTEM REMOTE INDICATORS

- A. 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 REMOTE ANNUNCIATOR

- A. 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.
 - 1. Mounting: Flush cabinet, NEMA 250, Class 1.

- B. 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 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.
- B. 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.

2.10 CELLULAR COMMUNICATOR TRANSMITTER

- A. Napco Starlink Fire LTE Commercial
- B. UL Listed.
- C. Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically communicates to the central station. When contact is made with the central station(s), the signal is transmitted.
- D. If needed remote antennas shall be installed to allow for communications to monitoring company.
- E. Communicator shall be compatible with the owner's monitoring company.
- F. Communicator shall be powered by the FACP.
- G. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.11 NETWORK COMMUNICATIONS

- H. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- I. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- J. Provide integration gateway using BACnet and Modbus protocol for connection to building automation system.

2.12 WIRE AND CABLE

- A. Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
 - 1. Twisted shielded pair, NFPA 70 Article 760, UL listed as Type FPLP, plenum rated and complying with requirements in UL 1424.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
- B. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct.
- C. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- D. Audible Alarm-Indicating Devices: Install per NFPA 72. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- E. Visible Alarm-Indicating Devices: Install per NFPA 72.
- F. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- G. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
- H. The contractor shall provide the following spare devices at a location determined by the engineer or fire marshal prior to final approval of shop drawings. Contractor shall be responsible for all conduit, wire, battery, cards etc. needed to install these spare devices. Devices not used shall be delivered to the owner as spare. Devices: 6 - horn/strobes (any candela), 2 - pull stations, 4 - smoke detectors, and 4 - control modules.

3.2 WIRING INSTALLATION

- A. Install wiring according to the following:
 - 1. NECA 1.
 - 2. TIA/EIA 568-A.
- B. Wiring Method:
 - 1. 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. Cable installed in plenum ceiling spaces shall be plenum rated. Fire alarm cable installed in walls, exposed areas or in inaccessible spaces shall be in conduit. All cable and conduit shall be concealed where possible.
 - 2. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.
- C. 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 crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- D. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
- E. 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.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum 1-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to "Basic Electrical Materials and Methods Electrical Identification."
- B. Install instructions frame in a location visible from the FACP.
- C. Paint power-supply disconnect switch red and label "FIRE ALARM CIRCUIT CONTROL."

3.4 GROUNDING

- A. Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.
 - 2. Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters.
 - 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.
 - 4. Testing: Follow procedure and record results complying with requirements in NFPA 72.
 - a. Detectors that are outside their marked sensitivity range shall be replaced.
 - 5. Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Appendix A in NFPA 70.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the fire alarm system, appliances, and devices. Provide a minimum of 2 hours of training to the Owner's Representative.

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