

**Department of Administration Purchasing Division** 2019 Washington Street East Post Office Box 50130 Charleston, WV 25305-0130

## State of West Virginia **Purchase Order**

Order Date: 05-01-2023

CORRECT ORDER NUMBER MUST APPEAR ON ALL PACKAGES, INVOICES, AND SHIPPING PAPERS. QUESTIONS CONCERNING THIS ORDER SHOULD BE DIRECTED TO THE DEPARTMENT CONTACT.

Order Number:	CPO 0211 4003 GSD2300000018 1	Procurement Folder: 1176204
Document Name:	Building 3 - Hydronic Boiler System Upgrades	Reason for Modification:
Document Description:	Building 3 - Hydronic Boiler System Upgrades	Award of CRFQ GSD2300000031
Procurement Type:	Central Purchase Order	
Buyer Name:	Melissa Pettrey	
Telephone:	(304) 558-0094	
Email:	melissa.k.pettrey@wv.gov	
Shipping Method:	Best Way	Effective Start Date:
Free on Board:	FOB Dest, Freight Prepaid	Effective End Date:

	VENDOR			DEPARTMENT CONTACT
Vendor Customer Code:	000000189985		Requestor Name:	Patrick S O'Neill
DSO MECHANICAL LLC			Requestor Phone:	304-352-5492
515 THIRD AVE			Requestor Email:	patrick.s.oneill@wv.gov
SO CHARLESTON	wv	25303		
US				
Vendor Contact Phone:	3047448479 Exten	sion: 101		
Discount Details:			9	2 %
Discount Allowed	Discount Percentage	Discount Days		3
#1 No	0.0000	0	FILE	LOCATION
#2 Not Entered				
#3 Not Entered				
#4 Not Entered				

INVOICE TO			SHIP TO		
DEPARTMENT OF ADMINISTRATION		DEPARTMENT OF ADMINISTRA	TION		
GENERAL SERVICES DIVISION		GENERAL SERVICES DIVISION	BLDG 3		
103 MICHIGAN AVENUE		1900 KANAWHA BLVD E			
CHARLESTON	WV 25305	CHARLESTON	WV 25305		
us		us			

Purchasing Division's File Copy

\$2,094,500.00 **Total Order Amount:** 

ENTERED

PURCHASING DIVISION AUTHORIZATION

ELECTRONIC SIGNATURE ON FILE 23

ATTORNEY GENERAL APPROVAL AS TO FORM

DATE:

ELECTRONIC SIGNATURE OF THE

ENCUMBRANCE CERTIFICATION 5-16-20-23 DATE: Beverly John

**ELECTRONIC SIGNATURE ON FILE** 

Page; 1

Date Printed: May 1, 2023 Order Number: CPO 0211 4003 GSD2300000018 1 FORM ID: WV-PRC-CPO-002 2020/05

#### **Extended Description:**

Central Purchase Order (CPO) CONSTRUCTION

The Vendor, DSO Mechanical LLC, of Charleston, WV, agrees to enter this one-time purchase contract with the Agency, WVDOA General Services Division for a contract for Building 3, Hydronic Boiler System Upgrades per the project manuals, attached bid requirements, specifications, terms and conditions, Addendum No. 1 dated 03/14/2023, Addendum No. 2 dated 03/27/2023, Addendum No. 3 dated 04/06/2023 and the Vendors submitted bid dated 04/13/2023 incorporated herein by reference and made a part hereof.

ZDS Design/Consulting Services is serving as the Architect on this project.

Commodity Code	Quantity	Unit	Unit Price	Total Price
72151000	0.00000		0.000000	2094500.00
Service To	Manufacturer		Model No	
	72151000	72151000 0.00000	72151000 0.00000	72151000 0.00000 0.000000

Commodity Line Description: Boiler and furnace construction and maintenance services

#### **Extended Description:**

Boiler and furnace construction and maintenance services

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### **GENERAL TERMS AND CONDITIONS:**

- 1. CONTRACTUAL AGREEMENT: Issuance of an Award Document signed by the Purchasing Division Director, or his designee, and approved as to form by the Attorney General's office constitutes acceptance by the State of this Contract made by and between the State of West Virginia and the Vendor. Vendor's signature on its bid, or on the Contract if the Contract is not the result of a bid solicitation, signifies Vendor's agreement to be bound by and accept the terms and conditions contained in this Contract.
- **2. DEFINITIONS:** As used in this Solicitation/Contract, the following terms shall have the meanings attributed to them below. Additional definitions may be found in the specifications included with this Solicitation/Contract.
- **2.1. "Agency"** or "**Agencies"** means the agency, board, commission, or other entity of the State of West Virginia that is identified on the first page of the Solicitation or any other public entity seeking to procure goods or services under this Contract.
- 2.2. "Bid" or "Proposal" means the vendors submitted response to this solicitation.
- **2.3. "Contract"** means the binding agreement that is entered into between the State and the Vendor to provide the goods or services requested in the Solicitation.
- **2.4. "Director"** means the Director of the West Virginia Department of Administration, Purchasing Division.
- **2.5. "Purchasing Division"** means the West Virginia Department of Administration, Purchasing Division.
- **2.6. "Award Document"** means the document signed by the Agency and the Purchasing Division, and approved as to form by the Attorney General, that identifies the Vendor as the contract holder.
- **2.7. "Solicitation"** means the official notice of an opportunity to supply the State with goods or services that is published by the Purchasing Division.
- **2.8. "State"** means the State of West Virginia and/or any of its agencies, commissions, boards, etc. as context requires.
- **2.9. "Vendor"** or **"Vendors"** means any entity submitting a bid in response to the Solicitation, the entity that has been selected as the lowest responsible bidder, or the entity that has been awarded the Contract as context requires.

3. CONTRACT TERM; RENEWAL; EXTENSION: The term of this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below:
☐ Term Contract
Initial Contract Term: The Initial Contract Term will be for a period of The Initial Contract Term becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as), and the Initial Contract Term ends on the effective end date also shown on the first page of this Contract.
Renewal Term: This Contract may be renewed upon the mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any request for renewal should be delivered to the Agency and then submitted to the Purchasing Division thirty (30) days prior to the expiration date of the initial contract term or appropriate renewal term. A Contract renewal shall be in accordance with the terms and conditions of the original contract. Unless otherwise specified below, renewal of this Contract is limited to successive one (1) year periods or multiple renewal periods of less than one year, provided that the multiple renewal periods do not exceed the total number of months available in all renewal years combined. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)
Alternate Renewal Term – This contract may be renewed for successive year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's office (Attorney General approval is as to form only)
<b>Delivery Order Limitations:</b> In the event that this contract permits delivery orders, a delivery order may only be issued during the time this Contract is in effect. Any delivery order issued within one year of the expiration of this Contract shall be effective for one year from the date the delivery order is issued. No delivery order may be extended beyond one year after this Contract has expired.
Fixed Period Contract: This Contract becomes effective upon Vendor's receipt of the notice to proceed and must be completed within Five Hundred sixty days (560) days.

receipt of the notice to proceed and part of the Contract more fully described in the attached specifications must be completed within days. Upon completion of the work covered by the preceding sentence, the vendor agrees that:
the contract will continue for years;
the contract may be renewed for successive year periods or shorter periods provided that they do not exceed the total number of months contained in all available renewals. Automatic renewal of this Contract is prohibited. Renewals must be approved by the Vendor, Agency, Purchasing Division and Attorney General's Office (Attorney General approval is as to form only).
One-Time Purchase: The term of this Contract shall run from the issuance of the Award Document until all of the goods contracted for have been delivered, but in no event will this Contract extend for more than one fiscal year.
Construction/Project Oversight: This Contract becomes effective on the effective start date listed on the first page of this Contract, identified as the State of West Virginia contract cover page containing the signatures of the Purchasing Division, Attorney General, and Encumbrance clerk (or another page identified as , and continues until the project for which the vendor is providing oversight is complete.
Other: Contract Term specified in
4. AUTHORITY TO PROCEED: Vendor is authorized to begin performance of this contract on the date of encumbrance listed on the front page of the Award Document unless either the box for "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked in Section 3 above. If either "Fixed Period Contract" or "Fixed Period Contract with Renewals" has been checked, Vendor must not begin work until it receives a separate notice to proceed from the State. The notice to proceed will then be incorporated into the Contract via change order to memorialize the official date that work commenced.
5. QUANTITIES: The quantities required under this Contract shall be determined in accordance with the category that has been identified as applicable to this Contract below.
Open End Contract: Quantities listed in this Solicitation/Award Document are approximations only, based on estimates supplied by the Agency. It is understood and agreed that the Contract shall cover the quantities actually ordered for delivery during the term of the Contract, whether more or less than the quantities shown.
Service: The scope of the service to be provided will be more clearly defined in the specifications included herewith.
Combined Service and Goods: The scope of the service and deliverable goods to be provided will be more clearly defined in the specifications included herewith.

One-Time Purchase: This Contract is for the purchase of a set quantity of goods that are identified in the specifications included herewith. Once those items have been delivered, no additional goods may be procured under this Contract without an appropriate change order approved by the Vendor, Agency, Purchasing Division, and Attorney General's office.
Construction: This Contract is for construction activity more fully defined in the specifications.
6. EMERGENCY PURCHASES: The Purchasing Division Director may authorize the Agency to purchase goods or services in the open market that Vendor would otherwise provide under this Contract if those goods or services are for immediate or expedited delivery in an emergency. Emergencies shall include, but are not limited to, delays in transportation or an unanticipated increase in the volume of work. An emergency purchase in the open market, approved by the Purchasing Division Director, shall not constitute of breach of this Contract and shall not entitle the Vendor to any form of compensation or damages. This provision does not excuse the State from fulfilling its obligations under a One-Time Purchase contract.
7. REQUIRED DOCUMENTS: All of the items checked in this section must be provided to the Purchasing Division by the Vendor as specified:
LICENSE(S) / CERTIFICATIONS / PERMITS: In addition to anything required under the Section of the General Terms and Conditions entitled Licensing, the apparent successful Vendor shall furnish proof of the following licenses, certifications, and/or permits upon request and in a form acceptable to the State. The request may be prior to or after contract award at the State's sole discretion.
The apparent successful Vendor shall also furnish proof of any additional licenses or certifications contained in the specifications regardless of whether or not that requirement is

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listed above.

8. INSURANCE: The apparent successful Vendor shall furnish proof of the insurance identified by a checkmark below prior to Contract award. The insurance coverages identified below must be maintained throughout the life of this contract. Thirty (30) days prior to the expiration of the insurance policies, Vendor shall provide the Agency with proof that the insurance mandated herein has been continued. Vendor must also provide Agency with immediate notice of any changes in its insurance policies, including but not limited to, policy cancelation, policy reduction, or change in insurers. The apparent successful Vendor shall also furnish proof of any additional insurance requirements contained in the specifications prior to Contract award regardless of whether that insurance requirement is listed in this section.

Vendor must maintain: Commercial General Liability Insurance in at least an amount of: \$1,000,000.00 occurrence. Automobile Liability Insurance in at least an amount of: \$1,000,000.00 occurrence. Professional/Malpractice/Errors and Omission Insurance in at least an amount of: per occurrence. Notwithstanding the forgoing, Vendor's are not required to list the State as an additional insured for this type of policy. Commercial Crime and Third Party Fidelity Insurance in an amount of: \_\_\_\_ per occurrence. \$100,000.00 Cyber Liability Insurance in an amount of: per occurrence. Builders Risk Insurance in an amount equal to 100% of the amount of the Contract. Pollution Insurance in an amount of: \_\_\_\_\_\_ per occurrence. Aircraft Liability in an amount of: per occurrence.

- **9. WORKERS' COMPENSATION INSURANCE:** Vendor shall comply with laws relating to workers compensation, shall maintain workers' compensation insurance when required, and shall furnish proof of workers' compensation insurance upon request.
- 10. VENUE: All legal actions for damages brought by Vendor against the State shall be brought in the West Virginia Claims Commission. Other causes of action must be brought in the West Virginia court authorized by statute to exercise jurisdiction over it.

11. LIQUIDATED DAMAGES: This clause shall in no way be considered exclusive and shall not limit the State or Agency's right to pursue any other available remedy. Vendor shall pay

iquidated damages in the	e amount specified below or as described in t	the specifications:
П <sub></sub>	for	<u>-</u>
	nages Contained in the Specifications.	
☐ Liquidated Dam	nages Are Not Included in this Contract.	

- 12. ACCEPTANCE: Vendor's signature on its bid, or on the certification and signature page, constitutes an offer to the State that cannot be unilaterally withdrawn, signifies that the product or service proposed by vendor meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise indicated, and signifies acceptance of the terms and conditions contained in the Solicitation unless otherwise indicated.
- 13. PRICING: The pricing set forth herein is firm for the life of the Contract, unless specified elsewhere within this Solicitation/Contract by the State. A Vendor's inclusion of price adjustment provisions in its bid, without an express authorization from the State in the Solicitation to do so, may result in bid disqualification. Notwithstanding the foregoing, Vendor must extend any publicly advertised sale price to the State and invoice at the lower of the contract price or the publicly advertised sale price.
- 14. PAYMENT IN ARREARS: Payments for goods/services will be made in arrears only upon receipt of a proper invoice, detailing the goods/services provided or receipt of the goods/services, whichever is later. Notwithstanding the foregoing, payments for software maintenance, licenses, or subscriptions may be paid annually in advance.
- 15. PAYMENT METHODS: Vendor must accept payment by electronic funds transfer and P-Card. (The State of West Virginia's Purchasing Card program, administered under contract by a banking institution, processes payment for goods and services through state designated credit cards.)
- 16. TAXES: The Vendor shall pay any applicable sales, use, personal property or any other taxes arising out of this Contract and the transactions contemplated thereby. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

- 17. ADDITIONAL FEES: Vendor is not permitted to charge additional fees or assess additional charges that were not either expressly provided for in the solicitation published by the State of West Virginia, included in the Contract, or included in the unit price or lump sum bid amount that Vendor is required by the solicitation to provide. Including such fees or charges as notes to the solicitation may result in rejection of vendor's bid. Requesting such fees or charges be paid after the contract has been awarded may result in cancellation of the contract.
- 18. FUNDING: This Contract shall continue for the term stated herein, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise made available, this Contract becomes void and of no effect beginning on July 1 of the fiscal year for which funding has not been appropriated or otherwise made available. If that occurs, the State may notify the Vendor that an alternative source of funding has been obtained and thereby avoid the automatic termination. Non-appropriation or non-funding shall not be considered an event of default.
- 19. CANCELLATION: The Purchasing Division Director reserves the right to cancel this Contract immediately upon written notice to the vendor if the materials or workmanship supplied do not conform to the specifications contained in the Contract. The Purchasing Division Director may also cancel any purchase or Contract upon 30 days written notice to the Vendor in accordance with West Virginia Code of State Rules § 148-1-5.2.b.
- **20. TIME:** Time is of the essence regarding all matters of time and performance in this Contract.
- 21. APPLICABLE LAW: This Contract is governed by and interpreted under West Virginia law without giving effect to its choice of law principles. Any information provided in specification manuals, or any other source, verbal or written, which contradicts or violates the West Virginia Constitution, West Virginia Code, or West Virginia Code of State Rules is void and of no effect.
- **22. COMPLIANCE WITH LAWS:** Vendor shall comply with all applicable federal, state, and local laws, regulations and ordinances. By submitting a bid, Vendor acknowledges that it has reviewed, understands, and will comply with all applicable laws, regulations, and ordinances.
  - **SUBCONTRACTOR COMPLIANCE:** Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to comply with all applicable laws, regulations, and ordinances. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.
- 23. ARBITRATION: Any references made to arbitration contained in this Contract, Vendor's bid, or in any American Institute of Architects documents pertaining to this Contract are hereby deleted, void, and of no effect.

- 24. MODIFICATIONS: This writing is the parties' final expression of intent.

  Notwithstanding anything contained in this Contract to the contrary no modification of this Contract shall be binding without mutual written consent of the Agency, and the Vendor, with approval of the Purchasing Division and the Attorney General's office (Attorney General approval is as to form only). Any change to existing contracts that adds work or changes contract cost, and were not included in the original contract, must be approved by the Purchasing Division and the Attorney General's Office (as to form) prior to the implementation of the change or commencement of work affected by the change.
- 25. WAIVER: The failure of either party to insist upon a strict performance of any of the terms or provision of this Contract, or to exercise any option, right, or remedy herein contained, shall not be construed as a waiver or a relinquishment for the future of such term, provision, option, right, or remedy, but the same shall continue in full force and effect. Any waiver must be expressly stated in writing and signed by the waiving party.
- 26. SUBSEQUENT FORMS: The terms and conditions contained in this Contract shall supersede any and all subsequent terms and conditions which may appear on any form documents submitted by Vendor to the Agency or Purchasing Division such as price lists, order forms, invoices, sales agreements, or maintenance agreements, and includes internet websites or other electronic documents. Acceptance or use of Vendor's forms does not constitute acceptance of the terms and conditions contained thereon.
- 27. ASSIGNMENT: Neither this Contract nor any monies due, or to become due hereunder, may be assigned by the Vendor without the express written consent of the Agency, the Purchasing Division, the Attorney General's office (as to form only), and any other government agency or office that may be required to approve such assignments.
- 28. WARRANTY: The Vendor expressly warrants that the goods and/or services covered by this Contract will: (a) conform to the specifications, drawings, samples, or other description furnished or specified by the Agency; (b) be merchantable and fit for the purpose intended; and (c) be free from defect in material and workmanship.
- **29. STATE EMPLOYEES:** State employees are not permitted to utilize this Contract for personal use and the Vendor is prohibited from permitting or facilitating the same.
- 30. PRIVACY, SECURITY, AND CONFIDENTIALITY: The Vendor agrees that it will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the Agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the Agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in <a href="http://www.state.wv.us/admin/purchase/privacy/default.html">http://www.state.wv.us/admin/purchase/privacy/default.html</a>.

31. YOUR SUBMISSION IS A PUBLIC DOCUMENT: Vendor's entire response to the Solicitation and the resulting Contract are public documents. As public documents, they will be disclosed to the public following the bid/proposal opening or award of the contract, as required by the competitive bidding laws of West Virginia Code §§ 5A-3-1 et seq., 5-22-1 et seq., and 5G-1-1 et seq. and the Freedom of Information Act West Virginia Code §§ 29B-1-1 et seq.

DO NOT SUBMIT MATERIAL YOU CONSIDER TO BE CONFIDENTIAL, A TRADE SECRET, OR OTHERWISE NOT SUBJECT TO PUBLIC DISCLOSURE.

Submission of any bid, proposal, or other document to the Purchasing Division constitutes your explicit consent to the subsequent public disclosure of the bid, proposal, or document. The Purchasing Division will disclose any document labeled "confidential," "proprietary," "trade secret," "private," or labeled with any other claim against public disclosure of the documents, to include any "trade secrets" as defined by West Virginia Code § 47-22-1 et seq. All submissions are subject to public disclosure without notice.

32. LICENSING: In accordance with West Virginia Code of State Rules § 148-1-6.1.e, Vendor must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, West Virginia Insurance Commission, or any other state agency or political subdivision. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Upon request, the Vendor must provide all necessary releases to obtain information to enable the Purchasing Division Director or the Agency to verify that the Vendor is licensed and in good standing with the above entities.

SUBCONTRACTOR COMPLIANCE: Vendor shall notify all subcontractors providing commodities or services related to this Contract that as subcontractors, they too are required to be licensed, in good standing, and up-to-date on all state and local obligations as described in this section. Obligations related to political subdivisions may include, but are not limited to, business licensing, business and occupation taxes, inspection compliance, permitting, etc. Notification under this provision must occur prior to the performance of any work under the contract by the subcontractor.

- 33. ANTITRUST: In submitting a bid to, signing a contract with, or accepting a Award Document from any agency of the State of West Virginia, the Vendor agrees to convey, sell, assign, or transfer to the State of West Virginia all rights, title, and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to Vendor.
- **34. VENDOR NON-CONFLICT:** Neither Vendor nor its representatives are permitted to have any interest, nor shall they acquire any interest, direct or indirect, which would compromise the performance of its services hereunder. Any such interests shall be promptly presented in detail to the Agency.

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35. VENDOR RELATIONSHIP: The relationship of the Vendor to the State shall be that of an independent contractor and no principal-agent relationship or employer-employee relationship is contemplated or created by this Contract. The Vendor as an independent contractor is solely liable for the acts and omissions of its employees and agents. Vendor shall be responsible for selecting, supervising, and compensating any and all individuals employed pursuant to the terms of this Solicitation and resulting contract. Neither the Vendor, nor any employees or subcontractors of the Vendor, shall be deemed to be employees of the State for any purpose whatsoever. Vendor shall be exclusively responsible for payment of employees and contractors for all wages and salaries, taxes, withholding payments, penalties, fees, fringe benefits, professional liability insurance premiums, contributions to insurance and pension, or other deferred compensation plans, including but not limited to, Workers' Compensation and Social Security obligations, licensing fees, etc. and the filing of all necessary documents, forms, and returns pertinent to all of the foregoing.

Vendor shall hold harmless the State, and shall provide the State and Agency with a defense against any and all claims including, but not limited to, the foregoing payments, withholdings, contributions, taxes, Social Security taxes, and employer income tax returns.

- 36. INDEMNIFICATION: The Vendor agrees to indemnify, defend, and hold harmless the State and the Agency, their officers, and employees from and against: (1) Any claims or losses for services rendered by any subcontractor, person, or firm performing or supplying services, materials, or supplies in connection with the performance of the Contract; (2) Any claims or losses resulting to any person or entity injured or damaged by the Vendor, its officers, employees, or subcontractors by the publication, translation, reproduction, delivery, performance, use, or disposition of any data used under the Contract in a manner not authorized by the Contract, or by Federal or State statutes or regulations; and (3) Any failure of the Vendor, its officers, employees, or subcontractors to observe State and Federal laws including, but not limited to, labor and wage and hour laws.
- 37. NO DEBT CERTIFICATION: In accordance with West Virginia Code §§ 5A-3-10a and 5-22-1(i), the State is prohibited from awarding a contract to any bidder that owes a debt to the State or a political subdivision of the State. By submitting a bid, or entering into a contract with the State, Vendor is affirming that (1) for construction contracts, the Vendor is not in default on any monetary obligation owed to the state or a political subdivision of the state, and (2) for all other contracts, neither the Vendor nor any related party owe a debt as defined above, and neither the Vendor nor any related party are in employer default as defined in the statute cited above unless the debt or employer default is permitted under the statute.
- **38. CONFLICT OF INTEREST:** Vendor, its officers or members or employees, shall not presently have or acquire an interest, direct or indirect, which would conflict with or compromise the performance of its obligations hereunder. Vendor shall periodically inquire of its officers, members and employees to ensure that a conflict of interest does not arise. Any conflict of interest discovered shall be promptly presented in detail to the Agency.

- 39. REPORTS: Vendor shall provide the Agency and/or the Purchasing Division with the following reports identified by a checked box below:

  ✓ Such reports as the Agency and/or the Purchasing Division may request. Requested reports may include, but are not limited to, quantities purchased, agencies utilizing the contract, total contract expenditures by agency, etc.
- Quarterly reports detailing the total quantity of purchases in units and dollars, along with a listing of purchases by agency. Quarterly reports should be delivered to the Purchasing Division via email at <a href="mailto:purchasing.division@wv.gov">purchasing.division@wv.gov</a>.
- **40. BACKGROUND CHECK:** In accordance with W. Va. Code § 15-2D-3, the State reserves the right to prohibit a service provider's employees from accessing sensitive or critical information or to be present at the Capitol complex based upon results addressed from a criminal background check. Service providers should contact the West Virginia Division of Protective Services by phone at (304) 558-9911 for more information.
- 41. PREFERENCE FOR USE OF DOMESTIC STEEL PRODUCTS: Except when authorized by the Director of the Purchasing Division pursuant to W. Va. Code § 5A-3-56, no contractor may use or supply steel products for a State Contract Project other than those steel products made in the United States. A contractor who uses steel products in violation of this section may be subject to civil penalties pursuant to W. Va. Code § 5A-3-56. As used in this section:
  - a. "State Contract Project" means any erection or construction of, or any addition to, alteration of or other improvement to any building or structure, including, but not limited to, roads or highways, or the installation of any heating or cooling or ventilating plants or other equipment, or the supply of and materials for such projects, pursuant to a contract with the State of West Virginia for which bids were solicited on or after June 6, 2001.
  - b. "Steel Products" means products rolled, formed, shaped, drawn, extruded, forged, cast, fabricated or otherwise similarly processed, or processed by a combination of two or more or such operations, from steel made by the open heath, basic oxygen, electric furnace, Bessemer or other steel making process.
  - c. The Purchasing Division Director may, in writing, authorize the use of foreign steel products if:
    - 1. The cost for each contract item used does not exceed one tenth of one percent (.1%) of the total contract cost or two thousand five hundred dollars (\$2,500.00), whichever is greater. For the purposes of this section, the cost is the value of the steel product as delivered to the project; or
    - 2. The Director of the Purchasing Division determines that specified steel materials are not produced in the United States in sufficient quantity or otherwise are not reasonably available to meet contract requirements.

42. PREFERENCE FOR USE OF DOMESTIC ALUMINUM, GLASS, AND STEEL: In Accordance with W. Va. Code § 5-19-1 et seq., and W. Va. CSR § 148-10-1 et seq., for every contract or subcontract, subject to the limitations contained herein, for the construction, reconstruction, alteration, repair, improvement or maintenance of public works or for the purchase of any item of machinery or equipment to be used at sites of public works, only domestic aluminum, glass or steel products shall be supplied unless the spending officer determines, in writing, after the receipt of offers or bids, (1) that the cost of domestic aluminum, glass or steel products is unreasonable or inconsistent with the public interest of the State of West Virginia, (2) that domestic aluminum, glass or steel products are not produced in sufficient quantities to meet the contract requirements, or (3) the available domestic aluminum, glass, or steel do not meet the contract specifications. This provision only applies to public works contracts awarded in an amount more than fifty thousand dollars (\$50,000) or public works contracts that require more than ten thousand pounds of steel products.

The cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than twenty percent (20%) of the bid or offered price for foreign made aluminum, glass, or steel products. If the domestic aluminum, glass or steel products to be supplied or produced in a "substantial labor surplus area", as defined by the United States Department of Labor, the cost of domestic aluminum, glass, or steel products may be unreasonable if the cost is more than thirty percent (30%) of the bid or offered price for foreign made aluminum, glass, or steel products. This preference shall be applied to an item of machinery or equipment, as indicated above, when the item is a single unit of equipment or machinery manufactured primarily of aluminum, glass or steel, is part of a public works contract and has the sole purpose or of being a permanent part of a single public works project. This provision does not apply to equipment or machinery purchased by a spending unit for use by that spending unit and not as part of a single public works project.

All bids and offers including domestic aluminum, glass or steel products that exceed bid or offer prices including foreign aluminum, glass or steel products after application of the preferences provided in this provision may be reduced to a price equal to or lower than the lowest bid or offer price for foreign aluminum, glass or steel products plus the applicable preference. If the reduced bid or offer prices are made in writing and supersede the prior bid or offer prices, all bids or offers, including the reduced bid or offer prices, will be reevaluated in accordance with this rule.

43. INTERESTED PARTY SUPPLEMENTAL DISCLOSURE: W. Va. Code § 6D-1-2 requires that for contracts with an actual or estimated value of at least \$1 million, the Vendor must submit to the Agency a disclosure of interested parties prior to beginning work under this Contract. Additionally, the Vendor must submit a supplemental disclosure of interested parties reflecting any new or differing interested parties to the contract, which were not included in the original pre-work interested party disclosure, within 30 days following the completion or termination of the contract. A copy of that form is included with this solicitation or can be obtained from the WV Ethics Commission. This requirement does not apply to publicly traded companies listed on a national or international stock exchange. A more detailed definition of interested parties can be obtained from the form referenced above.

- **44. PROHIBITION AGAINST USED OR REFURBISHED:** Unless expressly permitted in the solicitation published by the State, Vendor must provide new, unused commodities, and is prohibited from supplying used or refurbished commodities, in fulfilling its responsibilities under this Contract.
- **45. VOID CONTRACT CLAUSES:** This Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law.
- **46. ISRAEL BOYCOTT:** Bidder understands and agrees that, pursuant to W. Va. Code § 5A-3-63, it is prohibited from engaging in a boycott of Israel during the term of this contract.

## ADDITIONAL TERMS AND CONDITIONS (Construction Contracts Only)

1. CONTRACTOR'S LICENSE: Until June 15, 2021, West Virginia Code § 21-11-2, and after that date, § 30-42-2, requires that all persons desiring to perform contracting work in this state be licensed. The West Virginia Contractors Licensing Board is empowered to issue the contractor's license. Applications for a contractor's license may be made by contacting the West Virginia Contractor Licensing Board.

The apparent successful Vendor must furnish a copy of its contractor's license prior to the issuance of a contract award document.

- **2. BONDS:** The following bonds must be submitted:
  - a. BID BOND: Pursuant to the requirements contained in W. Va. Code § 5-22-1(c), All Vendors submitting a bid on a construction project shall furnish a valid bid bond in the amount of five percent (5%) of the total amount of the bid protecting the State of West Virginia. THE BID BOND MUST BE SUBMITTED WITH THE BID OR VENDOR'S BID WILL BE DISQUALIFIED.
  - b. PERFORMANCE BOND: The apparent successful Vendor shall provide a performance bond in the amount of 100% of the contract. The performance bond must be received by the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)
  - c. LABOR/MATERIAL PAYMENT BOND: The apparent successful Vendor shall provide a labor/material payment bond in the amount of 100% of the Contract value. The labor/material payment bond must be delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: <a href="https://www.state.wv.us/admin/purchase/forms2.html">www.state.wv.us/admin/purchase/forms2.html</a>)
  - d. MAINTENANCE BOND: The apparent successful Vendor shall provide a two (2) year maintenance bond covering the roofing system if the work impacts an existing roof. The amount of the bond must be equal to the price associated with the percentage of the project impacting the roof. The maintenance bond must be issued and delivered to the Purchasing Division prior to Contract award. (Attorney General requires use of the State approved bond forms found at: www.state.wv.us/admin/purchase/forms2.html)

In lieu of the Bid Bond, the Vendor may provide certified checks, cashier's checks, or irrevocable letters of credit. Any certified check, cashier's check, or irrevocable letter of credit provided in lieu of the bid bond must be of the same amount required of the Bid Bond and delivered with the bid.

- 3. DRUG-FREE WORKPLACE AFFIDAVIT: W. Va. Code § 21-1D-5 provides that any solicitation for a public improvement contract requires each Vendor that submits a bid for the work to submit an affidavit that the Vendor has a written plan for a drug-free workplace policy. If the affidavit is not submitted with the bid submission, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the affidavit within one business day of the request. Failure to submit the affidavit within one business day of receiving the request shall result in disqualification of the bid. To comply with this law, Vendor should complete the enclosed drug-free workplace affidavit and submit the same with its bid. Failure to submit the signed and notarized drugfree workplace affidavit or a similar affidavit that fully complies with the requirements of the applicable code, within one business day of being requested to do so shall result in disqualification of Vendor's bid. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is \$100,000 or less or temporary or emergency repairs.
- 3.1. DRUG-FREE WORKPLACE POLICY: Pursuant to W. Va. Code § 21-1D-4, Vendor and its subcontractors must implement and maintain a written drug-free workplace policy that complies with said article. The awarding public authority shall cancel this contract if: (1) Vendor fails to implement and maintain a written drug-free workplace policy described in the preceding paragraph, (2) Vendor fails to provide information regarding implementation of its drug-free workplace policy at the request of the public authority; or (3) Vendor provides to the public authority false information regarding the contractor's drug-free workplace policy.

Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is \$100,000 or less or temporary or emergency repairs.

- **4. DRUG FREE WORKPLACE REPORT:** Pursuant to W. Va. Code § 21-1D-7b, no less than once per year, or upon completion of the project, every contractor shall provide a certified report to the public authority which let the contract. For contracts over \$25,000, the public authority shall be the West Virginia Purchasing Division. For contracts of \$25,000 or less, the public authority shall be the agency issuing the contract. The report shall include:
- (1) Information to show that the education and training service to the requirements of West Virginia Code § 21-1D-5 was provided;
- (2) The name of the laboratory certified by the United States Department of Health and Human Services or its successor that performs the drug tests;
- (3) The average number of employees in connection with the construction on the public improvement;
- (4) Drug test results for the following categories including the number of positive tests and the number of negative tests: (A) Pre-employment and new hires; (B) Reasonable suspicion; (C) Postaccident; and (D) Random.

Vendor should utilize the attached Certified Drug Free Workplace Report Coversheet when submitting the report required hereunder. Pursuant to W. Va. Code 21-1D-2(b) and (k), this provision does not apply to public improvement contracts the value of which is \$100,000 or less or temporary or emergency repairs.

- **5. AIA DOCUMENTS:** All construction contracts that will be completed in conjunction with architectural services procured under Chapter 5G of the West Virginia Code will be governed by the attached AIA documents, as amended by the Supplementary Conditions for the State of West Virginia, in addition to the terms and conditions contained herein.
- **6. PROHIBITION AGAINST GENERAL CONDITIONS:** Notwithstanding anything contained in the AIA Documents or the Supplementary Conditions, the State of West Virginia will not pay for general conditions, or winter conditions, or any other condition representing a delay in the contracts. The Vendor is expected to mitigate delay costs to the greatest extent possible and any costs associated with Delays must be specifically and concretely identified. The state will not consider an average daily rate multiplied by the number of days extended to be an acceptable charge.
- 7. GREEN BUILDINGS MINIMUM ENERGY STANDARDS: In accordance with § 22-29-4, all new building construction projects of public agencies that have not entered the schematic design phase prior to July 1, 2012, or any building construction project receiving state grant funds and appropriations, including public schools, that have not entered the schematic design phase prior to July 1, 2012, shall be designed and constructed complying with the ICC International Energy Conservation Code, adopted by the State Fire Commission, and the ANSI/ASHRAE/IESNA Standard 90.1-2007: Provided, That if any construction project has a commitment of federal funds to pay for a portion of such project, this provision shall only apply to the extent such standards are consistent with the federal standards.
- **8. LOCAL LABOR MARKET HIRING REQUIREMENT:** Pursuant to West Virginia Code §21-1C-1 et seq., Employers shall hire at least seventy-five percent of employees for public improvement construction projects from the local labor market, to be rounded off, with at least two employees from outside the local labor market permissible for each employer per project.

Any employer unable to employ the minimum number of employees from the local labor market shall inform the nearest office of Workforce West Virginia of the number of qualified employees needed and provide a job description of the positions to be filled.

If, within three business days following the placing of a job order, Workforce West Virginia is unable to refer any qualified job applicants to the employer or refers less qualified job applicants than the number requested, then Workforce West Virginia shall issue a waiver to the employer stating the unavailability of applicant and shall permit the employer to fill any positions covered by the waiver from outside the local labor market. The waiver shall be in writing and shall be issued within the prescribed three days. A waiver certificate shall be sent to both the employer for its permanent project records and to the public authority.

Any employer who violates this requirement is subject to a civil penalty of \$250 per each employee less than the required threshold of seventy-five percent per day of violation after receipt of a notice of violation.

Any employer that continues to violate any provision of this article more than fourteen calendar days after receipt of a notice of violation is subject to a civil penalty of \$500 per each employee less than the required threshold of seventy-five percent per day of violation.

The following terms used in this section have the meaning shown below.

- (1) The term "construction project" means any construction, reconstruction, improvement, enlargement, painting, decorating or repair of any public improvement let to contract in an amount equal to or greater than \$500,000. The term "construction project" does not include temporary or emergency repairs;
- (2) The term "employee" means any person hired or permitted to perform hourly work for wages by a person, firm or corporation in the construction industry; The term "employee" does not include:(i) Bona fide employees of a public authority or individuals engaged in making temporary or emergency repairs;(ii) Bona fide independent contractors; or(iii) Salaried supervisory personnel necessary to assure efficient execution of the employee's work;
- (3) The term "employer" means any person, firm or corporation employing one or more employees on any public improvement and includes all contractors and subcontractors;
- (4) The term "local labor market" means every county in West Virginia and any county outside of West Virginia if any portion of that county is within fifty miles of the border of West Virginia;
- (5) The term "public improvement" includes the construction of all buildings, roads, highways, bridges, streets, alleys, sewers, ditches, sewage disposal plants, waterworks, airports and all other structures that may be let to contract by a public authority, excluding improvements funded, in whole or in part, by federal funds.

## 9. DAVIS-BACON AND RELATED ACT WAGE RATES:

	e work performed under this contract is federally funded in whole, or in part. Pursuant to				
	, Vendors are required to pay applicable Davis-Bacon				
wa	ge rates.				
	The week mentioned and an this contract is not ashing to Davis Dagon was noted				

The work performed under this contract is not subject to Davis-Bacon wage rates.

10. SUBCONTRACTOR LIST SUBMISSION: In accordance with W. Va. Code § 5-22-1, the apparent low bidder on a contract valued at more than \$250,000.00 for the construction, alteration, decoration, painting or improvement of a new or existing building or structure shall submit a list of all subcontractors who will perform more than \$25,000.00 of work on the project including labor and materials. (This section does not apply to any other construction projects, such as highway, mine reclamation, water or sewer projects.) The subcontractor list shall be provided to the Purchasing Division within one business day of the opening of bids for review. If the apparent low bidder fails to submit the subcontractor list, the Purchasing Division shall promptly request by telephone and electronic mail that the low bidder and second low bidder provide the subcontractor list within one business day of the request. Failure to submit the subcontractor list within one business day of receiving the request shall result in disqualification of the bid.

If no subcontractors who will perform more than \$25,000.00 of work are to be used to complete the project, the apparent low bidder must make this clear on the subcontractor list, in the bid itself, or in response to the Purchasing Division's request for the subcontractor list.

- a. Required Information. The subcontractor list must contain the following information:
  - i. Bidder's name
  - ii. Name of each subcontractor performing more than \$25,000 of work on the project.
  - iii. The license number of each subcontractor, as required by W. Va. Code § 21-11-1 et. seq.
  - iv. If applicable, a notation that no subcontractor will be used to perform more than \$25,000.00 of work. (This item iv. is not required if the vendor makes this clear in the bid itself or in documentation following the request for the subcontractor list.)
- b. Subcontractor List Submission Form: The subcontractor list may be submitted in any form, including the attached form, as long as the required information noted above is included. If any information is missing from the bidder's subcontractor list submission, it may be obtained from other documents such as bids, emails, letters, etc. that accompany the subcontractor list submission.
- c. Substitution of Subcontractor. Written approval must be obtained from the State Spending Unit before any subcontractor substitution is permitted. Substitutions are not permitted unless:
  - i. The subcontractor listed in the original bid has filed for bankruptcy;
  - ii. The subcontractor in the original bid has been debarred or suspended; or
  - iii. The contractor certifies in writing that the subcontractor listed in the original bid fails, is unable, or refuses to perform his subcontract.

## Subcontractor List Submission (Construction Contracts Only)

Bidder's Name:	DSO Mechanical LLC		
Check this be project.	x if no subcontractors will perfe	orm more th	an \$25,000.00 of work to complete the
Subcontractor Name			Number if Required by Code § 21-11-1 et. seq.
Trine		WVO	2 69 78
Willeman Con	struction	WU	600834
Dixon Ole Thermal	etrical.		028601
Thermal	Solutions	Low	030824

Attach additional pages if necessary

**DESIGNATED CONTACT:** Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

(Printed Name and Title	) <u>Mike</u>	Laughlin	Estimator	/Project Manager
(Address) 515 Third	Ave., Sou	th Charlesto	n, WV 253	03
(Phone Number) / (Fax l	Number) _	304-744-8	3479	304-744-8491
(Email address)m	laughlin@d	dsomech.com	n	

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that: I have reviewed this Solicitation/Contract in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes an offer to the State that cannot be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation/Contract for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that this bid or offer was made without prior understanding, agreement, or connection with any entity submitting a bid or offer for the same material, supplies, equipment or services; that this bid or offer is in all respects fair and without collusion or fraud; that this Contract is accepted or entered into without any prior understanding, agreement, or connection to any other entity that could be considered a violation of law; that I am authorized by the Vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on Vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

By signing below, I further certify that I understand this Contract is subject to the provisions of West Virginia Code § 5A-3-62, which automatically voids certain contract clauses that violate State law: and that pursuant to W. Va. Code 5A-3-63, the entity entering into this contract is prohibited from engaging in a boycott against Israel.

DSO Med	chanical LLC		
(Company)	$\sim$		
(Signature of Authori Mike Laughlin	zed Representative) Estimator/Project Manager	04/13/2023	
(Printed Name and T	itle of Authorized Representative	c) (Date)	
304-744-8479	304-744-8491		
(Phone Number) (Fax	Number)		
	mlaughlin@dsome	ch.com	
(Email Address)			

## REQUEST FOR QUOTATION

## Bldg. 3 Hydronic Boiler System Upgrades

## GENERAL CONSTRUCTION SPECIFICATIONS

- 1. **PURPOSE AND SCOPE:** The West Virginia Purchasing Division is soliciting bids on behalf of the General Services Division to establish a contract for Hydronic Boiler System Upgrades. ZDS Design/Consulting Services is serving as the Architect on this project.
- **2. Definitions:** The terms listed below shall have the meanings assigned to them below. Additional definitions can be found in section 2 of the General Terms and Conditions and in the Specifications Manual as defined below.
  - **2.1.** "Construction Services" means construction of Hydronic Boiler System as more fully described in these specifications and the Specifications/Project Manual.
  - **2.2.** "Pricing Page" means the pages contained in wvOASIS, attached hereto, or included in the Specifications/Project Manual upon which Vendor should list its proposed price for the Construction Services.
  - **2.3.** "Solicitation" means the official notice of an opportunity to supply the State with Construction Services that is published by the Purchasing Division.
  - 2.4. "Specifications/Project Manual" means the American Institute of Architect forms, specifications, plans, drawings, and related documents developed by the architect, engineer, or Agency that provide detailed instructions on how the Construction Services are to be performed along with any American Institute of Architects documents ("AIA documents") attached thereto.
- **3. ORDER OF PRECEDENCE:** This General Construction Specifications document will have priority over, and supersede, anything contained in the Specifications/Project Manual.
- **Qualifications:** Vendor, or Vendor's staff if requirements are inherently limited to individuals rather than corporate entities, shall have the following minimum qualifications:
  - 4.1. Experience: Vendor, or Vendor's supervisory staff assigned to this project, must have successfully completed at least three (3) projects that involved work similar to that described in the Specifications/Project Manual. Compliance with this experience requirement will be determined prior to contract award by the State through references provided by the Vendor upon request, through knowledge or documentation of the Vendor's past projects, through confirmation of experience requirements from the architect assisting the State in this project, or some other method that the State determines to be acceptable. Vendor must provide any documentation requested by the State to assist in confirmation of compliance with this provision. References, documentation, or other information to confirm compliance with this experience requirement may be requested after bid opening and prior to contract award.
- **5. CONTRACT AWARD:** The Contract is intended to provide Agency with a purchase price for the Construction Services. The Contract will be awarded to the lowest qualified responsible bidder meeting the required specifications. If the Pricing Pages contain alternates/add-ons, the Contract will be awarded based on the grand total of the base bid and any alternates/add-ons selected.

## REQUEST FOR QUOTATION

## **Bldg. 3 Hydronic Boiler System Upgrades**

- **6. SELECTION OF ALTERNATES:** Pursuant to W. Va. Code § 5-22-1(f), any solicitation of bids shall include no more than five alternates. Alternates, if accepted, shall be accepted in the order in which they are listed on the bid form. Any unaccepted alternate contained within a bid shall expire 90 days after the date of the opening of bids for review. Determination of the lowest qualified responsible bidder shall be based on the sum of the base bid and any alternates accepted. Alternate selection will be identified in the Purchase Order.
- 7. PROGRESS PAYMENTS: The Vendor will be paid in the form of periodic progress payments for work completed. Payment requests along with documentation supporting the request will be submitted to and reviewed by the Architect. If approved, the Architect will communicate approval to the Owner and Owner will process payment. The Owner reserves the right to withhold liquidated damages from progress payments. Progress payments will be made no more than monthly.

Approval and payment of progress payments will be based on Contractor's submission of a payment allocation schedule which allocates the entire contract sum to payment milestones. Architect and Owner will review the payment allocation and may mandate changes that they believe are necessary.

- **8. RETAINAGE:** Agency is entitled to withhold ten (10) percent from each progress payment made as retainage. Agency will partially release retainage upon certification of substantial completion by the Architect in accordance with this Contract but will continue to retain amounts sufficient to cover activities needed to reach final completion.
- **9. PERFORMANCE:** Vendor shall perform the Construction Services in accordance with this document and the Project Plans.
- 10. SUBSTANTIAL AND FINAL COMPLETION: Vendor shall achieve substantial completion by Five Hundred & Thirty (530) Calendar Days and final completion by Five Hundred & Sixty (560) Calendar Days. Failure to meet the deadlines established herein, unless extended by change order authorizing additional time free of liquidated damages, will result in liquidated damages being applied.
- 11. LIQUIDATED DAMAGES: Vendor shall pay Liquidated Damages in the amount of \$1,000.00 per calendar day for every calendar day beyond the date for Final Completion, as established by the issuance of the Notice to Proceed, for which Final Completion has not been achieved.
- **12. PROJECT PLANS:** Copies of the project plans can be obtained by contacting the entity identified below.

ZDS Design/Consulting Services
Todd Zachwieja (Contact@ZDSDesign.com)
135 Corporate Center Drive, Suite 532
Scott Depot, WV, 25560

Charleston Blueprint
1203 Virginia Street E.
Charleston, WV 25301
(304) 343-1063
(Hard copies can be obtained here pay directly to printer)

## REQUEST FOR QUOTATION

## **Bldg. 3 Hydronic Boiler System Upgrades**

Copies of project plans can be examined at the following locations.

ZDS Design/Consulting Services 135 Corporate Center Drive, Suite 532 Scott Depot, WV, 25560

- **13. SUBSTITUTIONS:** Any substitution requests must be submitted in accordance with the official question and answer period described in the INSTRUCTIONS TO VENDORS SUBMITTING BIDS, Paragraph 4. Vendor Question Deadline.
- **14. FACILITIES ACCESS:** Performance of Contract Services may require access cards and/or keys to gain entrance to Agency's facilities. In the event that access cards and/or keys are required:
  - **14.1.** Vendor must identify principal service personnel which will be issued access cards and/or keys to perform service.
  - **14.2.** Vendor will be responsible for controlling cards and keys and will pay replacement fee, if the cards or keys become lost or stolen.
  - **14.3.** Vendor shall notify Agency immediately of any lost, stolen, or missing card or key.
  - **14.4.** Anyone performing under this Contract will be subject to Agency's security protocol and procedures.
  - **14.5.** Vendor shall inform all staff of Agency's security protocol and procedures.

## **15.** MISCELLANEOUS:

**15.1. WEST VIRGINIA JOBS ACT COMPLIANCE:** Item 8 of the ADDITIONAL TERMS AND CONDITIONS (Construction Contracts Only) provides an overview of the requirements of West Virginia Code §21-1C. Pursuant to §21-1C-5(b), Agency, acting as the public authority, requires employers to file, with the Division of Labor copies of the waiver (from Workforce West Virginia) certificates and certified payrolls (or other comparable documents) that include the number of employees, the county and state wherein the employee reside and their occupation. Employers shall copy General Service Division Project Management on emails of submissions to JobsAct@wv.gov. Employer is responsible for submission of documentation for all subcontractors involved with this project.

## REQUEST FOR QUOTATION Bldg. 3 Hydronic Boiler System Upgrades CRFQ GSD2300000031

15.2. Contract Manager: During its performance of this Contract, Vendor must designate and maintain a primary contract manager responsible for overseeing Vendor's responsibilities under this Contract. The Contract manager must be available during normal business hours to address any customer service or other issues related to this Contract. Vendor should list its Contract manager and his or her contact information below.

Contract Manager: Mike Laughlin

Telephone Number: 304-744-8479

Fax Number: 304-744-8491

mlaughlin@dsomech.com

15.3. Owner's Representative: Owner's representative for notice purposes is:

Name: Patrick O'Neill

Email Address:

Telephone Number: 304-352-5514

Fax Number: 304-558-1475

Email Address: Patrick.S.ONeill@wv.gov

**16.** Initial Decision Maker: ZDS Design/Consulting Services, the Architect, shall serve as the Initial Decision Maker in matters relating to this contract.

## REQUEST FOR QUOTATION Bldg. 3 Hydronic Boiler System Upgrades CRFQ GSD2300000031

Exhibit	A	Pricing	Page
---------	---	---------	------

Name of Bidder:			
The Bidder, being familiar	with and understanding	•	 xamined the

The Bidder, being familiar with and understanding the Bidding Documents, and also having examined the site and being familiar with all local conditions affecting the project hereby proposes to furnish all labor, material, equipment, supplies and transportation necessary to perform all Work in accordance with the Bidding Documents within the time set forth for the sum of:

Base Bid \$ 2, 094, 500



Department of Administration Purchasing Division 2019 Washington Street East Post Office Box 50130 Charleston, WV 25305-0130

## State of West Virginia Centralized Request for Quote Construction

Proc Folder:	1176204				Reason for Modification:		
Doc Description:	Building 3 - Hydronic Boiler	System Upgrade	es		Addendum No. 3		
Proc Type:	Central Purchase Order						
	Solicitation Closes	Solicitation No			Version		
	2023-04-13 13:30	CRFQ 0211	GSD2300000031		4		
BID RECEIVING LC	CATION			V Sife			
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DEPARTMENT OF	ADMINISTRATION						
PURCHASING DIVI	SION						
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CHARLESTON	WV 25305						
US ————————————————————————————————————							
VENDOR							
Vendor Customer (	Code:						
Vendor Name :							
Address :							
Street :							
City:							
State :	State : Country : Zi			Zip:			
Principal Contact :							
Vendor Contact Phone: Extension:							
	CONTACT THE BUYER						
Melissa Pettrey							
304) 558-0094							

All offers subject to all terms and conditions contained in this solicitation

FEIN#

Date Printed: Apr 6, 2023 Page: 1

Signature X

DATE

## SOLICITATION NUMBER: CRFQ GSD2300000031 Addendum Number: 3

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

[	]	Modify bid opening date and time
[	]	Modify specifications of product or service being sought
[•	<b>/</b> ]	Attachment of vendor questions and responses
[	1	Attachment of pre-bid sign-in sheet
[	]	Correction of error

## **Description of Modification to Solicitation:**

[ / Other

**Applicable Addendum Category:** 

Addendum is issued to publish and distribute the following information to the Vendor community.

- 1. To provide responses to Vendor Technical Questions received by 3/30/2023, per Attachment A.
- 2. To provide clarifications to items from the Drawings and Specifications of this solicitation, per Attachment A. No other changes.

**Additional Documentation:** Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

### **Terms and Conditions:**

- 1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.
- 2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

## ATTACHMENT A

# Bldg. 3 Hydronic Boiler System Upgrades GSD Project # GSD1176204 Addendum #3 Attachment Prepared by ZDS Design/Consulting Services ZDS Project #GSD221C

## **QUESTIONS & ANSWERS**

- **Q 1.** Dwg. M701, keynote 9 "MC to field verify extent of work required for installation of new meter and new valving to include all costs in bid." Please provide additional clarification and explanation of this note.
- A 1. The existing piping shall be modified as required for the installation of the new flow meter, ball valves and control valve and coordinate with manufacturer for proper installation. Refer to section #3.8 of specification 230933, drawings M701, MP901 and attached sketch for location and additional information.
- Q 2. Dwg. MS101, keynotes #1 and #2 Is the work of cutting and capping the abandoned PCDR in Bldg. 5, AHU-5 Mechanical Room to be from the interior of the building, or the exterior of the building? Is the existing abandoned pipe to be pulled from the building wall, and the wall infilled?
- A 2. The existing piping referenced shall be cut and capped inside the building wall of Building #3 and Building #5. Clean and paint the water stains on the wall to match existing color to be approved by the Owner.
- Q 3. Dwg. MS101, Keynote #2 and Dwg. MS102, Keynote 1 Is work of cutting and capping the abandoned PCDR in Manhole #3 to be from the interior of the manhole, or from the exterior of manhole? Is the existing abandoned pipe to be pulled from the manhole wall, and wall infilled?
- A 3. There is no abandoned PCDR in Manhole #3. The existing 6" HPS will be cut and capped at the tee inside the manhole and cut and capped on the exterior of the manhole. Remove the HPS piping through the manhole wall, patch wall and seal watertight with materials having a temperature rating above 400 degrees F. Refer to details on drawing M502.
- Q 4. Dwg. MH101, Keynote 3 states "shall provide 304 stainless steel condensate piping", to be used to boiler to the acid neutralization tank, with copper condensate drain piping from tank to floor drain. Dwg. M501, Detail 15, Boiler Condensate Acid Neutralizer Detail, notes that piping from boiler to condensate neutralizer tank is 1" PVC condensate piping. Which piping material from boiler to Condensate Neutralizer Tank is to be used, PVC or 304SS?
- A 4. Piping from boiler to neutralization tank shall be 304 SS, and from tank to drain shall be copper.

SEE ADDITIONAL NOTES BELOW:

# Bldg. 3 Hydronic Boiler System Upgrades GSD Project # GSD1176204 Addendum #3 Attachment Prepared by ZDS Design/Consulting Services ZDS Project #GSD221C

## **DRAWINGS & SPECIFICATIONS**

Site Plan - Drawing MS101, ADD Notes:

## Protection of trees and soils during construction:

Prior to beginning construction that may disturb the trees, verify the tree(s) are healthy. If suspected to not be healthy, notify the Owner/Engineer before proceeding. Regularly water before and during construction if rainfall is not adequate (whenever soil is dry 6 inches below the surface).

Contractor shall disturb no more than 25 percent of the roots within the dripline for any tree, protect species to the dripline, and allow extra space beyond the dripline for sensitive species. For all trees, avoid needless or excessive damage.

Install a layer of wood chips at least 12 inches deep over areas that will be used for traffic or material storage in areas that will be used for future planting, and over tree roots outside of the protected root zone (PRZ). Where trucks will be moving across such areas, increase wood chip depth to 18 inches.

Ensure that tree roots and soils are not exposed to adverse chemical changes during construction. Chemical spill damage can be prevented by filling gas tanks, cleaning paintbrushes and tools, and repairing mechanical equipment well outside tree PRZs. All building debris and chemical wastes must be hauled away for proper disposal. Avoid changes in soil pH (acidity). Increases in pH are particularly dangerous to many species. Alkaline clays or limestones shall not be used for fill or paving, and concrete shall be mixed on a thick plastic tarp or outside the site. Mixing trucks shall never be rinsed out on the site.

If any construction damage occurs to trees, address problems as soon as possible, photograph the damage, and inform Owner/Engineer immediately. Liquidated damages, where applicable, may be levied. Irrigate trees during construction whenever soil is dry 6 inches below the soil surface. Also irrigate thoroughly before and after trees receive any kind of direct damage (e.g., severed roots).

If roots are cut, cut cleanly to promote quick wound closure and regeneration. Vibratory plows, chain trenchers, and hand tools do a better job at this than bulldozers and backhoes. Minimize damage by avoiding excavation during hot, dry weather; keeping the plants well-watered before and after digging; and covering exposed roots with soil, mulch, or damp burlap as soon as possible.

If utilities must be installed under existing tree root zone, use installation techniques that will minimize root damage. Damaged roots can reduce water and nutrient uptake and may compromise the stability of the tree. If it is not possible to relocate the utility line outside the tree's PRZ, you can reduce root damage by as much as 25 percent by tunneling under the tree's root system. When digging a trench near a tree, begin tunneling when you encounter

# Bldg. 3 Hydronic Boiler System Upgrades GSD Project # GSD1176204 Addendum #3 Attachment Prepared by ZDS Design/Consulting Services ZDS Project #GSD221C

roots larger than one inch in diameter." Another technique that can minimize root damage when installing utilities is to use an air spade to excavate the utility trench under root zone.

## Pavilion Plumbing Plan - Drawing P101, Clarifications:

- Gas Meter Assembly Contractor shall contact the gas utility (contact information on Drawing M000) and coordinate all requirements for the new service and meter assembly. Contractor shall be responsible for furnishing and installing all piping, valves, meter set, etc. as required by the Utility for a completed installation.
- 2. Keynote #5, change 2 ½" to 2" as shown on the floor plan for boiler connections.
- Contractor shall furnish and install a gas flow meter as indicated on the attached two (2) sketches and installation detail. Coordinate all power requirements with the Electrical Contractor for a complete and operational system.

## Specification Section 013100 Clarification:

 DELETE 1.11 Time of Completion in its entirety and refer to State issued documents for Project completion schedule. Project schedule will be discussed during the Prebid Conference.

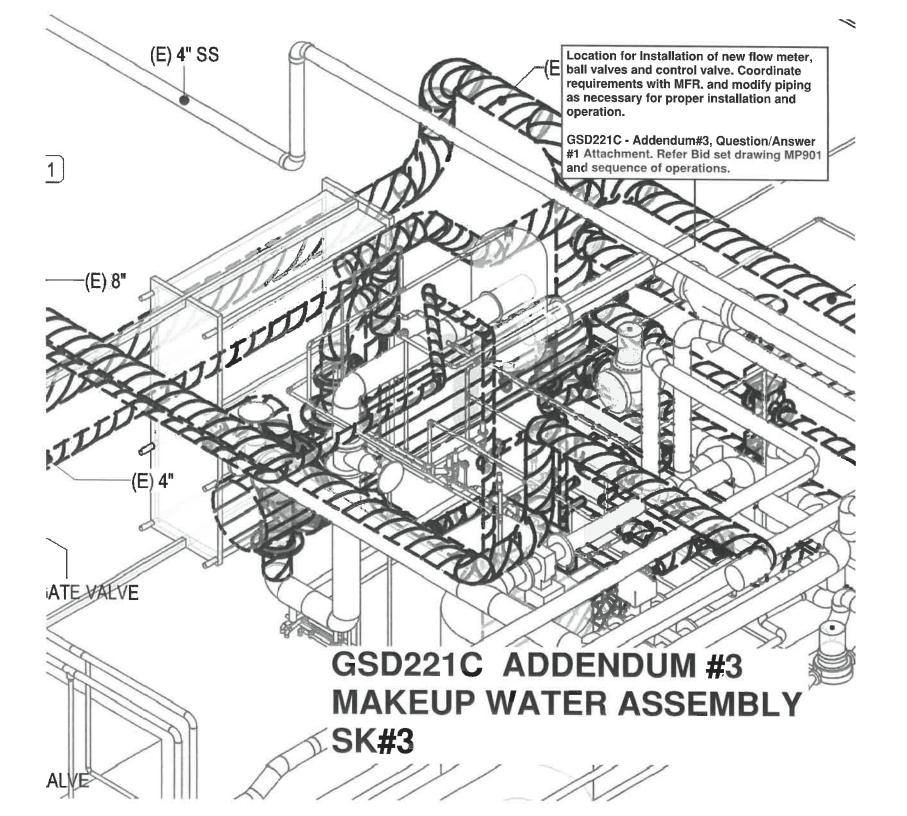
### Attachments:

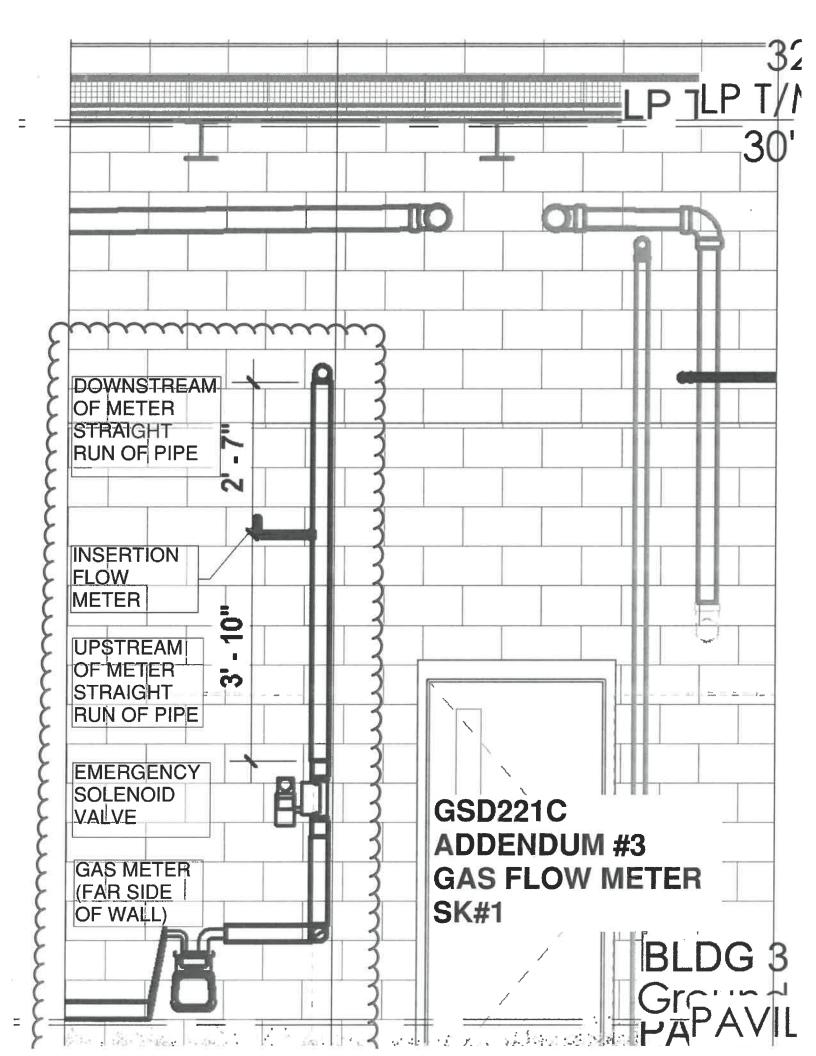
SK#3 - Makeup Water Assembly

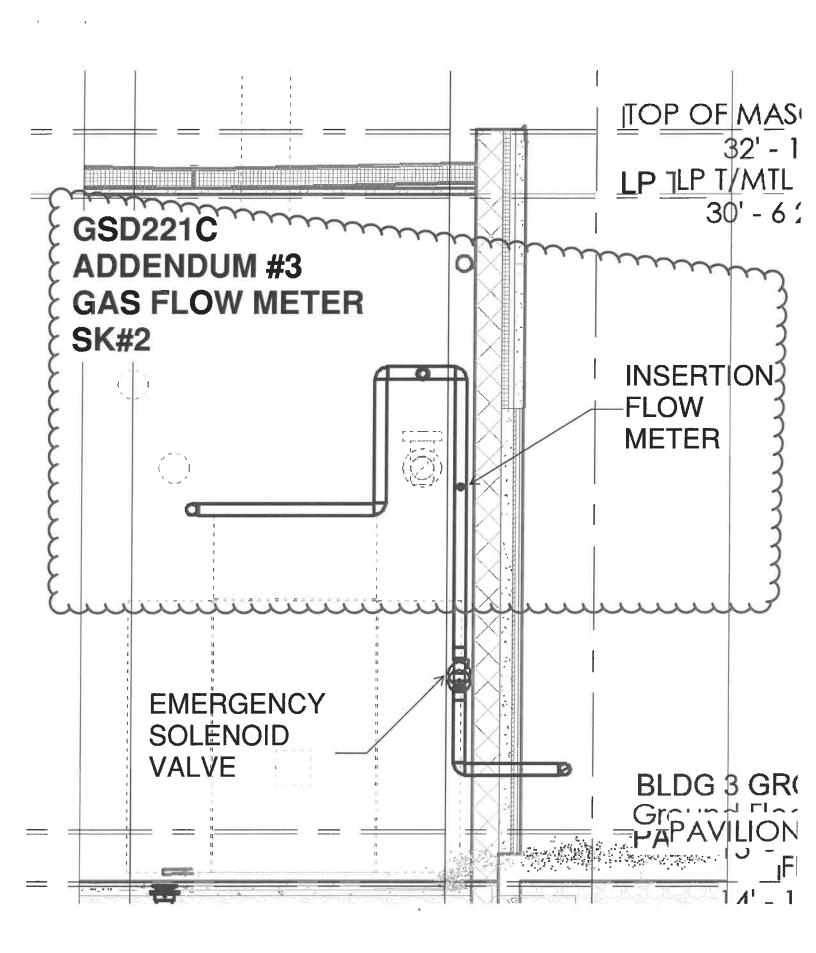
SK#1 - Gas Flow Meter

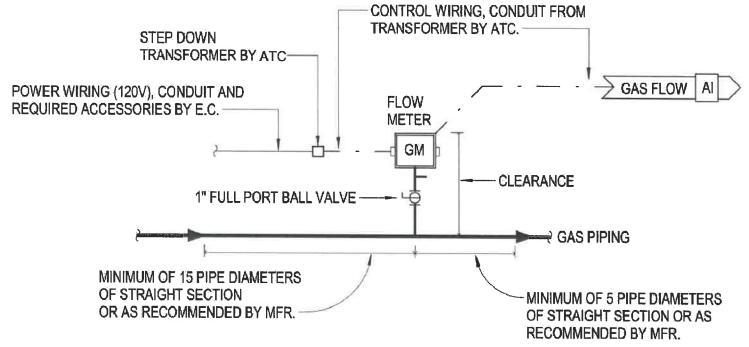
SK#2 - Gas Flow Meter

Detail - Gas Flow Meter









- 1. PROVIDE FOX THERMAL MODEL FT2A THERMAL MASS INSERTION STYLE FLOW METER WITH A REMOTE MOUNTED DISPLAY OR EQUIVALENT GAS FLOW METER SHALL BE FURNISHED BY CONTROLS CONTRACTOR AND INSTALLED BY PLUMBING CONTRACTOR.
- 2. PLUMBING CONTRACTOR SHALL INSTALL GAS FLOW METER AS PER MFR. RECOMMENDATIONS FOR PROPER OPERATION AND COORDINATE WITH ATC. ATC SHALL DISPLAY MONITORING POINTS ASSOCIATED WITH GAS FLOW METER ON THE BOILER PLANT GRAPHICS.
- 3. ALL POWER WIRING BY E.C. AND CONTROLS WIRING BY CONTROLS CONTRACTOR.
- 4. REFER TO SKETCHES FOR LOCATION.

NOTES:

GAS FLOW METER

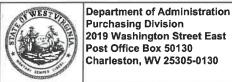
SCALE: NONE

# ADDENDUM ACKNOWLEDGEMENT FORM SOLICITATION NO.: CRFQ GSD2300000031

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received: (Check the box next to each addendum received)
✓ Addendum No. 1
I understand that failure to confirm the receipt of addenda may be cause for rejection of this bit I further understand that any verbal representation made or assumed to be made during any ora discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.
Company
Authorized Signature
Date
NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.



# State of West Virginia Centralized Request for Quote Construction

D E. Ida	4470004				
Proc Folder:	1176204			- 1	Reason for Modification:
Doc Description:	Building 3 - Hydronic Boiler System Upgrades			/	Addendum No. 2
Proc Type:	Central Purchase Order				
Date Issued	Solicitation Closes	Solicitation No		1	Version
2023-03-27	2023-04-13 13:30	CRFQ 0211	GSD2300000031	3	3
BID RECEIVING LO	OCATION			g.L.A	
BID CLERK					
DEPARTMENT OF	ADMINISTRATION				
PURCHASING DIV	ISION				
2019 WASHINGTO	N ST E				
CHARLESTON	WV 25305				
US					
VENDOR					
Vendor Customer	Code:				
Vendor Name :					
Address :					
Street :					
City:					
State :		Country:		Zip :	
Principal Contact	:				
Vendor Contact PI	none:	E	Extension:		
	N CONTACT THE BUYER				
Melissa Pettrey (304) 558-0094					
(304) 556-0094 melissa.k.pettrey@v	vv.gov				

All offers subject to all terms and conditions contained in this solicitation

Vendor Signature X

 Date Printed:
 Mar 27, 2023
 Page: 1
 FORM ID: WV-PRC-CRFQ-002 2020/05

DATE

FEIN#

# SOLICITATION NUMBER: CRFQ GSD2300000031 Addendum Number: 2

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

## **Applicable Addendum Category:**

[ <b>\</b> ]	Modify bid opening date and time
[ ]	Modify specifications of product or service being sought
[ 🗸 ]	Attachment of vendor questions and responses
[ ]	Attachment of pre-bid sign-in sheet
[ ]	Correction of error
[1]	Other

## **Description of Modification to Solicitation:**

Addendum is issued to publish and distribute the following information to the Vendor community.

- 1. To establish a secondary technical question period with a deadline of 3:00 pm on Thursday, March 30, 2023, and extend Bid Opening due date until 1:30 pm on Thursday, April 13, 2023.
- 2. To publish responses to Vendor technical questions received by the initial Technical Question deadline, per Attachment A.
- 3. To publish Emergency Natural Gas Appliance Shut Down Control Schematic, per Attachment A.

No other changes.

**Additional Documentation:** Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

## **Terms and Conditions:**

1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.

+

2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

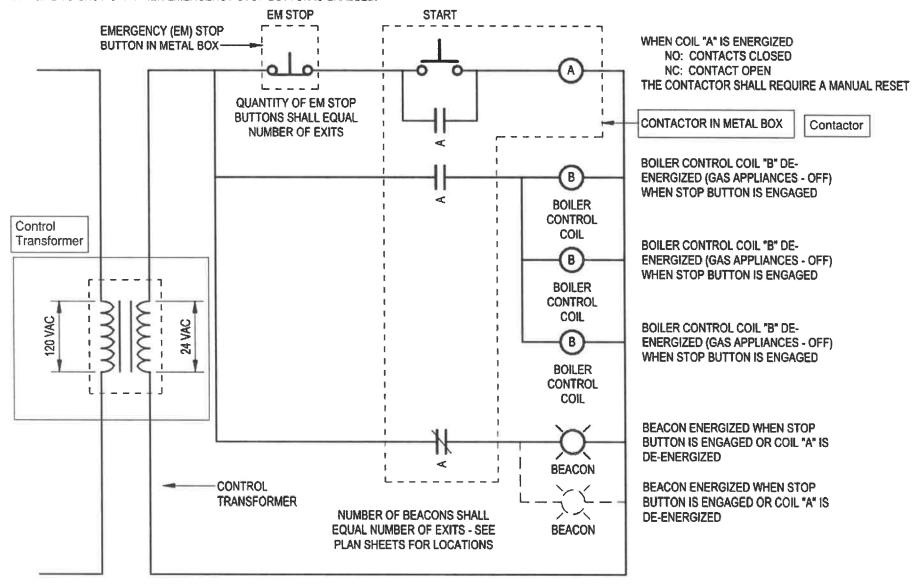
## ATTACHMENT A

# **Bldg. 3 Hydronic Boiler System Upgrades** Responses to Vendor Technical Questions

- Q 1. Dwg. E401- General Note 7

  No information provide on the location of the existing Fire Alarm panel, the existing capacity of its secondary power source, or locations of existing initiation and notification circuits and devices. Please advise.
- A 1. The Alarm Control Panel for the building is located on the first floor in the room labeled "Fire Command" with room number "111" in Building #3. The capacity of its secondary power source is currently unknown, and the contractor will need to conduct a field verification to determine its capacity. In addition, the contractor will also need to identify the locations of the existing initiation and notification circuits and devices.
- Q 2. Dwg. E401 Keynote 4
  Where is the enclosed contactor and transformer shown on M702 in the emergency natural gas shutdown control schematic located? Who will supply these items? (Is there a BMS panel to control this system?)
- A 2. The control transformer and contactor associated with emergency natural gas shutdown system are shown on detail #2 on M702. Please see the attachment that highlights transformer and contactors. "Refer to specification 230993 section #3.4". These items and wiring shall be provided by ATC. The status and alarm points associated with the emergency natural gas shutdown system shall be displayed on the Boiler Plant graphics. ATC shall coordinate and allocate required space on the new BMS panel to control/monitor this system as required to meet the sequence of operations.
- Q 3. We are requesting a vendor question deadline extension, along with a bid date extension, for this project. This will allow for a more competitive and thorough bid by both vendors, subs, and price contractors. At a minimum, a vendor question deadline extension past today's cutoff date is needed.
- A 3. Questions deadline shall be extended by one week to 3:00 pm on March 30, 2023. Bid due date will be extended by one week to 1:30 pm on April 13, 2023.

M702



EMERGENCY BOILER SHUT DOWN SYSTEM - REFER TO SEQUENCE OF OPERATION SPECIFICATION

EMERGENCY NATURAL GAS APPLIANCE EMERGENCY SHUT DOWN CONTROL SCHEMATIC NOT TO SCALE

# ADDENDUM ACKNOWLEDGEMENT FORM SOLICITATION NO.: CRFQ GSD2300000031

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received: (Check the box next to each addendum	received)
☐ Addendum No. 1 ☐ Addendum No. 2 ☐ Addendum No. 3 ☐ Addendum No. 4 ☐ Addendum No. 5	☐ Addendum No. 6 ☐ Addendum No. 7 ☐ Addendum No. 8 ☐ Addendum No. 9 ☐ Addendum No. 10
I further understand that any verbal repr discussion held between Vendor's repre	receipt of addenda may be cause for rejection of this bid resentation made or assumed to be made during any oral esentatives and any state personnel is not binding. Only ided to the specifications by an official addendum is
Company	
Authorized Signature	
Date	
NOTE: This addendum acknowledgeme document processing.	ent should be submitted with the bid to expedite



Signature X

Department of Administration Purchasing Division 2019 Washington Street East Post Office Box 50130 Charleston, WV 25305-0130

# State of West Virginia Centralized Request for Quote Construction

Proc Folder:	1176204		Reason for Modification:
	: Building 3 - Hydronic Boiler System Upgrades		Addendum No. 1
	•	, , , ,	
Proc Type:	Central Purchase Order		
Date Issued	Solicitation Closes	Solicitation No	Version
2023-03-14	2023-04-06 13:30	CRFQ 0211 GSD2300000031	2
BID RECEIVING LO	CATION		
BID CLERK			
DEPARTMENT OF	ADMINISTRATION		
PURCHASING DIVI			
2019 WASHINGTO			
CHARLESTON	WV 25305		
us			
VENDOR			
Vendor Customer	Code:		
Vendor Name :			
Address:			
Street:			
City:			
State :		Country:	Zip:
Principal Contact :			
Vendor Contact Ph	ione:	Extension:	
	N CONTACT THE BUYER		
Melissa Pettrey			
(304) 558-0094 melissa.k.pettrey@w	W GOV		
menssa.k.petrey@v	, v. 90 v		
Vendor			

All offers subject to all terms and conditions contained in this solicitation

 Date Printed:
 Mar 14, 2023
 Page: 1
 FORM ID: WV-PRC-CRFQ-002 2020/05

DATE

FEIN#

## SOLICITATION NUMBER: CRFQ GSD2300000031 Addendum Number: 1

The purpose of this addendum is to modify the solicitation identified as ("Solicitation") to reflect the change(s) identified and described below.

Appli	icable	e A	ddendum Category:
	[	]	Modify bid opening date and time
	[	]	Modify specifications of product or service being sought
	[	]	Attachment of vendor questions and responses
	[ 🗸	]	Attachment of pre-bid sign-in sheet
	[	]	Correction of error
	[	1	Other

## **Description of Modification to Solicitation:**

Addendum is issued to publish and distribute the following information to the Vendor community.

1 Publish the pre-bid sign-in sheet, per Attachment A.

No other changes.

**Additional Documentation:** Documentation related to this Addendum (if any) has been included herewith as Attachment A and is specifically incorporated herein by reference.

## **Terms and Conditions:**

- 1. All provisions of the Solicitation and other addenda not modified herein shall remain in full force and effect.
- 2. Vendor should acknowledge receipt of all addenda issued for this Solicitation by completing an Addendum Acknowledgment, a copy of which is included herewith. Failure to acknowledge addenda may result in bid disqualification. The addendum acknowledgement should be submitted with the bid to expedite document processing.

## ATTACHMENT A

# **Pre-Bid Sign-In Sheet**

Solicitation Number: CRFQ GSD2300000031

Date of Pre-Bid Meeting: 3/14/2023

Location of Prebid Meeting: Bldg. 7 Capitol Room

## Please Note:

Vendors must sign-in on this sheet to verify attendance at the Pre-Bid meeting. Failure to legibly sign in may be grounds for declaring a vendor ineligible to bid. For further verification, please also provide a business card if possible.

Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	Fax #:	Email:
N:tro Construction Services	Jamie Kuhn	4360 1st Ave Nitro WU 25143	384 932 6995		jkuhn anitro es.com
Aso Mechanical	Jeff Kalley	515 3rd Avenue. South Charleston	301-744-8479		ikellagedsomech.com
Duxon Electrical	Berin Food	3352 Norwood Rd Hontington, W 25705	304-97-2875		Hornfoore to Van Menna 1
Powell Inc	John Powel!	P.c Bex 361 Barbustsvill	304-638-7647		Jehn. powall & powallounte
Casto Tech	PAUL LAWLASTER	540 Leon	304346-0549	s.	Plancastere castotecho co
TLC Contracting	Gang Powell	440 Clay Lick Branch RD Charlesten UV 25812	304 -544 -7832		TLC contracting LCO Yanco. con

<sup>\*</sup>One Vendor Per Representative - No one individual is permitted to represent more than one vendor at the pre-bid meeting. Any individual that does attempt to represent two or more vendors will be required to select one vendor to which the individual's attendance will be attributed. The vendors not selected will be deemed to have not attended the pre-bid meeting unless another individual attended on their behalf.

# **Pre-Bid Sign-In Sheet**

Solicitation Number: CRFQ GSD2300000031

Date of Pre-Bid Meeting: 3/14/2023

Location of Prebid Meeting: Bldg. 7 Capitol Room

## Please Note:

Vendors must sign-in on this sheet to verify attendance at the Pre-Bid meeting. Failure to legibly sign in may be grounds for declaring a vendor ineligible to bid. For further verification, please also provide a business card if possible.

Firm Represented:*	Rep Name (Printed):	Firm Address:	Telephone #:	<u>Fax #:</u>	Email:
TRANE	JOHN WILLIAMS	10384 Wallace polley 57. Kingsport To	423-794 6334		JWILLIAMS 4 & TARE Con
		600 50 Th	304-925-		exics mith @
Dougheaty	Efic Smith	Charleston VV	6664		dougherty co. con
Murray Sheet Meson	Josh Tulles	3112 NUMBERS LOV	304-482-0982		jeulliuse mwrayshretmchl.co
Dixon Glactricol	Chad Sisemore	Auntilytes, WV			chada dimelectrical, con
Engrel Weldy	Tim Engel	51 Alsons w.	304-610-311		tensoloenselwed em

<sup>\*</sup>One Vendor Per Representative - No one individual is permitted to represent more than one vendor at the pre-bid meeting. Any individual that does attempt to represent two or more vendors will be required to select one vendor to which the individual's attendance will be attributed. The vendors not selected will be deemed to have not attended the pre-bid meeting unless another individual attended on their behalf.

## ADDENDUM ACKNOWLEDGEMENT FORM SOLICITATION NO.: CRFQ GSD2300000031

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✓ Addendum No. 1	
I understand that failure to confirm the receipt of addenda may be call further understand that any verbal representation made or assumed discussion held between Vendor's representatives and any state personant the information issued in writing and added to the specifications by a binding.	to be made during any oral onnel is not binding. Only
Company	
Authorized Signature	
Date	
NOTE: This addendum acknowledgement should be submitted with document processing.	the bid to expedite



## General Conditions of the Contract for Construction

## for the following PROJECT:

(Name and location or address)

WV State Capitol Complex Building 3 Hydronic Boiler System Upgrades

## THE OWNER:

(Name, legal status and address)

WV General Services Division 103 Michigan Avenue Charleston, WV 25311 Telephone Number: 304-558-2317

### THE ARCHITECT:

(Name, legal status and address)

ZDS Design/Consulting Services ZDS is the Engineer of Record for this project. In all locations of this and attached forms, delete "Architect" and add "Engineer" 135 Corporate Center Drive, Suite 532

Scott Depot, WV 25560

Telephone Number: 304-755-0075

## TABLE OF ARTICLES

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- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
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- 11 INSURANCE AND BONDS
- 12 UNCOVERING AND CORRECTION OF WORK
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### **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.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

Init.

- TERMINATION OR SUSPENSION OF THE CONTRACT 14
- 15 **CLAIMS AND DISPUTES**

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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 or proposal 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. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

## § 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.

- § 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.
- § 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 retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and 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 the 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 suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, 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 suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

## § 1.6 Notice

- § 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.
- § 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AlA Document E203<sup>TM</sup>—2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203<sup>TM</sup>-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202™-2013. Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

#### **OWNER** ARTICLE 2

## § 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 Evidence of the Owner's Financial Arrangements

- § 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.
- § 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.
- § 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.
- § 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

## § 2.3 Information and Services Required of the Owner

- § 2.3.1 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.
- § 2.3.2 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.

- § 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.
- § 2.3.4 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.
- § 2.3.5 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.
- § 2.3.6 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.

## § 2.4 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.

§ 2.5 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 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 default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for 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. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

## 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 its 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 2.3.4, 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 submit 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, subject to Section 15.1.7, 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures may not be safe, the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative 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 approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 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

- § 3.5.1 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.
- § 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

## § 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 14 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 that an equitable adjustment be made 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, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim 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 notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice 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 and Submittal Schedules

- § 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.
- § 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably 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, or fails to provide submittals in accordance with the approved 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 make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

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 how 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect 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 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.
- § 3.12.10.1 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 be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately 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 and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and 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.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

## § 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, 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, or patching shall be restored to the condition existing prior to the cutting, fitting, or 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 construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its 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 and 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 the Owner shall be entitled to reimbursement from the Contractor.

## § 3.16 Access to Work

The Contractor shall provide the Owner and Architect with 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 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 an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the 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 Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.
- § 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.

## § 4.2 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.
- § 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 promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) 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

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

- § 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 13.4.2 and 13.4.3, whether or not the 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, 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 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 order 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 Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.
- § 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 the 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, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice 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 for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

## § 5.3 Subcontractual Relations

By appropriate written agreement, 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 that the Contractor, by these Contract 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
  - 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; and
  - .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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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 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 term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.
- § 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 any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its 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 or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has 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 notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work 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. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.
- § 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 that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor 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. The Contractor shall proceed promptly with changes in the Work, 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:
  - The change in the Work; .1
  - .2 The amount of the adjustment, if any, in the Contract Sum; and
  - 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:
  - Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to .1 permit evaluation;
  - Unit prices stated in the Contract Documents or subsequently agreed upon;
  - Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
  - As provided in Section 7.3.4.
- § 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine 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 7.3.4 shall be limited to the following:

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- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .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, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.
- § 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.
- § 7.3.6 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.
- § 7.3.7 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.
- § 7.3.8 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 may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

# 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, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.
- § 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 (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended 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

- § 9.1.1 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.
- § 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

# § 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent 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. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and 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.

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- § 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 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, suppliers, or other persons or entities that 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 (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole 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 in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. 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. 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 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 suppliers for labor, materials or equipment;

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- reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum; .4
- .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 either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.
- § 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.
- § 9.5.4 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 supplier to whom the 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 Contractor shall reflect such payment on its next Application 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 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 and suppliers 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 or supplier, except as may otherwise be required by law.
- § 9.6.5 The Contractor's payments to 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 or provided by 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, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.
- § 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 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' 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 shutdown, 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; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and 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 the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the 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 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.

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§ 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 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. 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 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, (3) a written statement that the Contractor knows of no 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, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and 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, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance 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 the lien, claim, security interest, or encumbrance, 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, corrected, 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 the 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;
  - .3 terms of special warranties required by the Contract Documents; or
  - .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.
- § 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a 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, a Subcontractor, or a Sub-subcontractor; 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 implement, 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 the owners and users of adjacent sites and utilities of the safeguards.
- § 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. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is 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, notice of the 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 and Substances

- § 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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 notify the Owner and Architect of the condition.
- § 10.3.2 Upon receipt of the Contractor's 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 the material or substance or who are to perform the task of removal or safe containment of the 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 by the amount of the Contractor's reasonable additional costs of shutdown, delay, and

- § 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 hazardous 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 hazardous 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 reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances 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 reimburse 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.

#### **INSURANCE AND BONDS ARTICLE 11**

# § 11.1 Contractor's Insurance and Bonds

- § 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.
- § 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.
- § 11.1.3 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.
- § 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

#### § 11.2 Owner's Insurance

- § 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.
- § 11.2.2 Fallure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.
- § 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

#### § 11.3 Waivers of Subrogation

- § 11.3.1 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; (2) the Architect and Architect's consultants; and (3) Separate Contractors, 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 those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.
- § 11.3.2 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, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.
- § 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

User Notes:

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

#### §11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement 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 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

#### 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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

#### § 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before 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 any 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 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 2.5.

- § 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 of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.
- § 12.25 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, excluding that jurisdiction's choice of law rules. 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 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 the assignment.

# § 13.3 Rights and Remedies

- § 13.3.1 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.
- § 13.3.2 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 thereunder, except as may be specifically agreed upon in writing.

## § 13.4 Tests and Inspections

§ 13.4.1 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 tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

- § 13.4.2 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 13.4.1, 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 13.4.3, shall be at the Owner's expense.
- § 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 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.
- § 13.4.4 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.
- § 13.4.5 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.
- § 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties 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.

#### TERMINATION OR SUSPENSION OF THE CONTRACT ARTICLE 14

§ 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, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

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
- Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the .3 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
- The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.
- § 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, 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' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

**User Notes:** 

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work 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' 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 or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
  - .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 reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner 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' 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 under 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 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 Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

## 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, a change in the Contract Time, 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. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

#### § 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the 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 15.1.2.

#### § 15.1.3 Notice of Claims

- § 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by 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 under this Section 15.1.3.1 shall 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.
- § 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

# § 15.1.4 Continuing Contract Performance

- § 15.1.4.1 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.
- § 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

#### § 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

# § 15.1.6 Claims for Additional Time

- § 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 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.
- § 15.1.6.2 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.

**User Notes:** 

# § 15.1.7 Waiver of 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 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### § 15.2 Initial Decision

- § 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, 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. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a 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 the 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 receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, 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 15.1.7, 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 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.
- § 15.3.4 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.

## § 15.4 Arbitration

- § 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.
- § 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.
- § 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.
- § 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

#### § 15.4.4 Consolidation or Joinder

- § 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 those of the Owner and Contractor under this Agreement.

# State of West Virginia

# Supplementary Conditions to AIA Document A201-2017 General Conditions of the Contract for Construction

The following Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

Order of Precedence: The documents contained in the contract to which this document has been attached shall be interpreted in the following order of precedence:

First Priority - Documents developed by the State or agency and utilized to provide public notice of the solicitation, along with other general terms and conditions shall be first in priority.

Second Priority – This document "Supplementary Conditions to the AIA Document A201-2017 General Conditions of the Contract for Construction" shall be second in priority.

Third Priority – all other AIA documents including, but not limited to, the AIA Document A201-2017 General Conditions of the Contract for Construction and the A101-2017 Standard Form of Agreement Between Owner and Contractor (when utilized) shall be third or lower in priority.

# ARTICLE 1 GENERAL PROVISIONS

Add the following Section to Article 1:

# \$1.05 PARTY RELATIONS

§1.05 The Owner and their consultants, the Architect and their Consultants, and the Contractor and their Subcontractors agree to proceed with the Work on the basis of mutual trust, good faith and fair dealing.

## §1.1 BASIC DEFINITIONS

#### **§1.1.1** THE CONTRACT DOCUMENTS

§1.1.1 Delete the last sentence of this Section and substitute the following:

The Contract Documents also include the Bidding Documents (Advertisement or Invitation to Bid, Request for Quotations/Bids, Instructions to Bidders, Form of Proposal, Bid Bond and Sample Forms), Performance Bond, Payment Bond, Maintenance Bond (if applicable), Certificates of Insurance, Special Provisions For Disadvantaged and Women Business Enterprise Utilization (If bound herein).

# §1.1.2 THE CONTRACT

§1.1.2 Make the following changes to Section 1.1.2:

in the last sentence, insert "and the Contractor" after "The Architect" and delete "the Architect's" and insert "their respective".

# §1.2 Correlation and Intent of Contract Documents

§1.2.1.1 In the second sentence, remove "any law" and insert "West Virginia law or any applicable federal law". In the last sentence, remove "by law" and insert "West Virginia law or any applicable federal law".

## §1.7 Digital Data Use and Transmission

§1.7 Delete the last sentence of this section in its entirety.

# §1.8 Building Information Models Use and Reliance

§ 1.8 Remove this section in its entirety and replace it with the following:

"Any use of, or reliance on, all or a portion of a building information model must be approved in advance by Owner and will only be permitted if the Parties have agreed upon and executed written documents to memorialize protocols governing the use of, and reliance on, the information contained in the model."

# ARTICLE 2 OWNER

# §2.1 GENERAL

§ 2.1.1 Add the following after the last sentence:

Notwithstanding the foregoing, the parties understand that since Owner is a government entity, change orders will often require approval by entities in addition to owner. When owner is a state agency, those entities may include, but are not limited to, the West Virginia Attorney General's Office and the West Virginia Purchasing Division. Additionally, approval may be required by agencies providing project funding, including but not limited to, West Virginia School Building Authority and agencies of the United States federal government.

- §2.1.2 Delete Section 2.1.2 in its entirety.
- §2.1 Add the following Section to 2.1:
  - \$2.1.3 The Owner and the agency funding the project reserve the right to maintain a full time or part time project representative (sometimes referred to as the "Clerk of the Works") at the project site who shall keep the Owner informed of the progress and quality of the Work and responsibilities. The Contractor shall cooperate and assist the Clerk of the Works in the performance of his/her duties. The Clerk of the Works will not interfere with or be responsible for the Contractor's supervision and direction of the Work, and the Contractor's means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work. The Clerk of the Works may facilitate communications between the Owner, Architect, and Contractor but has no authority to make decisions for the Owner, approve modifications to the Contract Documents, the Contract Time, or Contract Sum. Additionally, Contractor is not permitted to rely on or consider decisions made by the Clerk of the Works on behalf of Owner
- §2.2 Evidence of the Owner's Financial Arrangements: Delete § 2.2 and all of its subsections in its entirety.
- §2.3 Information and Services Required of Owner
- §2.3.2 Make the following changes to Section 2.3.2:

In first sentence, delete the period and add ", when required pursuant to West Virginia Code §30-12-1 et seq." Add the following sentence at the end of Section 2.3.2: "If the Owner does not retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located, the Owner will appoint an individual to assume the role and obligations of the Architect pursuant to this Agreement."

\$2.3.3 Delete this section in its entirety.

§2.3.4 Delete the last sentence of Section 2.3.4 and substitute the following:

The Contractor shall confirm the locations of each utility. If the Owner has provided geotechnical and other tests to determine subsurface conditions, the Owner will provide such documents to the Contractor, the Contractor acknowledges that it will make no claims for any subsurface or any other conditions revealed by these tests.

# ARTICLE 3 CONTRACTOR

- §3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR
- §3.2.2 Add the following sentence to the end of Section 3.2.2:

Claims by Contractor resulting from its failure to familiarize itself with the site shall be deemed waived. Additionally, by submitting a bid or otherwise entering into this contract, Contractor acknowledges that it has reviewed and understands the contract documents and the work required by those documents. Any claims arising from Contractor's failure to review and understand the contract documents shall be deemed waived.

- §3.2.3 Delete Section 3.2.3 in its entirety and substitute the following:
  - §3.2.3 The Contractor acknowledges its continuing duty to review and evaluate the Construction Documents during performance of its services and shall immediately notify the Owner and the Architect about any problems, conflicts, defects, deficiencies, inconsistencies or omissions it discovers in or between the Construction Documents; and variances it discovers between the Construction Documents and applicable laws, statutes, building codes, rules and regulations.
- § 3.2.4 Add the following clauses to Section 3.2.4:
  - §3.2.4.1 If the Contractor performs any Work which it knows or should have known involves a recognized problem, conflict, defect, deficiency, inconsistency or omission in the Construction Documents; or a variance between the Construction Documents and requirements of applicable laws, statutes, building codes, rules and regulations, without notifying the Owner and the Architect prior to receiving written authorization from the Architect to proceed, the Contractor shall be responsible for the consequences of such performance.
  - §3.2.4.2 Before ordering any materials or doing any Work, the Contractor and Subcontractors shall verify all measurements at the site and shall be responsible for the correctness of same. Discrepancies shall be reported in writing to the Architect prior to proceeding with the Work. No extra charge or compensation will be

entertained due to differences between actual measurements and dimensions indicated on the drawings, if such differences do not result in a change in the scope of Work or if the Architect failed to receive written notice before the Work was performed.

# 53.4 LABOR AND MATERIALS

§3.4.1 Vendor must review and comply with the following statutory requirements affecting public construction projects, as well as any other applicable laws that are not referenced herein:

- W. Va. Code § 5-19-1 et seq., relating to domestic steel preference.
- W. Va. Code § 5A-3-56 relating to domestic steel preference, provided that the Owner is a state agency subject to Chapter 5A, Article 3 of the W. Va. Code.
- W. Va. Code § §21-1C-1 et seq., relating to local hiring preference
- W. Va. Code §21-1D-1 et seq., relating to drug free workplace requirements.

# §3.4 Add the following Sections to 3.4:

§3.4.4 Where materials and equipment are to be provided by the Owner under the Contract Documents, the Contractor shall notify the Owner in writing as to when materials and equipment are required on the project site in sufficient time to avoid delay in the Work.

§3.4.5 The Contractor shall employ labor on the Project or in connection with the Work, capable of working harmoniously with all trade crafts and any other individuals associated with the Project. The Contractor shall also use its best efforts and implement policies and practices to minimize the likelihood of any strike, work stoppage or other labor disturbance. Except as specifically provided in this Agreement, Contractor shall not be entitled to any adjustment in the Contract sum or Contract time and shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes, or strikes by the work force of or provided by Contractor or its Subcontractors.

# §3.5 WARRANTY

# §3.5 Add the following sentence at the end of Section 3.5;

The Contractor agrees to assign to the Owner at time of Final Completion of the Work, any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such a manner so as to preserve any and all such warranties.

# §3.8 ALLOWANCES

# §3.8.3 Make the following change to Section 3.8.3:

§3.8.3 Delete "with reasonable promptness" and insert "in sufficient time to avoid delay in the Work."

# Add the following Section to 3.8:

§3.8.4 The Contractor shall promptly submit to the Owner an itemized account of any expenditure by the Contractor of the Contract allowance in sufficient detail to allow the Owner to properly account for such expenditure.

## §3.9 SUPERINTENDENT/PROJECT MANAGER

§3.9.1 Add the following sentence to the end of Section 3.9.1:

The Contractor may also employ a competent project manager.

§3.9.2 Make the following changes to Section 3.9.2:

In the first sentence, add "and project manager, if applicable" after "superintendent." In the second sentence, add "or project manager, if applicable," after "superintendent."

§3.9.3 Make the following changes to Section 3.9.3:

In the first sentence, add 'or project manager, if applicable," after "superintendent." In the second sentence, add "or project manager, if applicable," after "superintendent."

§3.9 Add the following Section to 3.9:

§3.9.4 The Owner shall have the right, at any time, to direct a change in the Contractor's representatives if their performance is deemed unsatisfactory.

# §3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§3.10.1 Make the following changes to Section 3.10.1:

in the first sentence, delete the word "promptly" and substitute "by the earliest reasonable date".

Add the following sentence to the end of Section 3.10.1: "The Contractor shall submit an updated construction schedule with each payment application, unless waived by the Owner."

Add the following Sections to 3.10:

§3.10.4 At any time after the first thirty (30) days of the Contract Time, if it is found that the project is two (2) weeks or more behind schedule, beyond approved time extensions, or if at any time during

the last thirty (30) days of the scheduled Contract Time the Contractor is one (1) week or more behind schedule, the Contractor shall immediately submit a plan to the Owner describing how the Work will be placed back on schedule within the remaining Contract Time.

\$3.10.5 If the Owner and the Architect determine that the performance of the Work during any stage of the construction schedule last approved by the Owner has not progressed or reached the level of completion required by the Contract Documents, the Owner will have the right to order the Contractor to take corrective measures (hereinafter referred to collectively as Extraordinary Measures) necessary to expedite the progress of the Work, including, without limitation: (1) working additional shifts or overtime; (2) supplying additional manpower, equipment and facilities; and (3) other similar measures. Such Extraordinary Measures shall continue until the progress of the Work complies with the last approved construction schedule. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule after allowing for approved extensions of Contract Time as provided elsewhere in this Agreement. The Contractor is not entitled to an adjustment in the Contract Sum in connection with any Extraordinary Measures required by the Owner. The Owner may exercise its rights under this Section as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with the construction schedule.

# §3.11 DOCUMENTS AND SAMPLES AT THE SITE

§3.11 Insert the following sentence at the end of Section 3.11:

The Contractor's compliance with this Section 3.11 shall be a condition precedent to any obligation of the Owner to make Final Payment pursuant to this Agreement.

# §3.15 CLEANING UP

§3.15.2 Delete Section 3.15.2 in its entirety and substitute the following:

§3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and may withhold such reasonable costs as necessary for the fulfillment of the Contractor's obligation under this Section 3.15. If the reasonable costs of such cleaning exceed the Contract Sum then due the Contractor, the Contractor shall reimburse the Owner the difference within thirty (30) consecutive calendar days of the Owner's written request.

Any materials, tools, supplies, or other personal property left by the Contractor shall be deemed abandoned property and the Owner shall have no obligation to hold or store the property on behalf of Contractor and may dispose of the abandoned property as if it were property of the State of West Virginia. Provided however, that prior to treating property as abandoned and disposing of it, Owner must

first provide Contractor with 10 days notice of its intent to do so. If any materials, tools, supplies or other personal property belong to a subcontractor, then Contractor is obligated to communicate this notice to its subcontractor immediately.

# §3.15 Add the following Section to 3.15:

§3.15.3 In order to achieve Substantial Completion, as defined by Section 9.8, for any portion of the Work, the Contractor must have the area where the Work is located fully cleaned and all materials and/or debris removed from site. The Certificate of Substantial Completion will not be issued until the Contractor has met this obligation.

# ARTICLE 4 ARCHITECT

# **§4.1 GENERAL**

# 64.2 ADMINISTRATION OF THE CONTRACT

§4.2 Make the following changes to Section 4.2:

§4.2.1 In the first sentence of Section 4.2.1 after the word Architect add ", unless otherwise indicated by the Owner,".

§4.2.2 In the first sentence of Section 4.2.2 strike the word "generally."

§4.2.3 In the first sentence of Section 4.2.3 strike the word "reasonably."

§4.2.5 Add the following sentence at the end of Section 4.2.5:

The Architect upon receipt of an Application for Payment from the Contractor shall either review and certify such amounts due for payment or return such Application for Payment to the Contractor for correction(s) within five (5) consecutive business days of receipt.

§4.2.7 Delete the first sentence of Section 4.2.7 and substitute the following:

The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples for the purpose of checking for conformance with the Contract Documents.

Modify the second to last sentence by removing it in its entirety and replacing it with the following: The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures, unless the Architect has established the required construction means, methods, techniques, sequences, or procedures, or the Contract Documents require such approval.

§4.2.8 Make the following change to Section 4.2.8:

In the first sentence, after the word Architect add ", in consultation with the Owner,".

# ARTICLE 5 SUBCONTRACTORS

- \$5.2 Award of Subcontracts and Other Contracts for Portions of Work
- §5.2.1 Add the following sentence to Section 5.2.1.

This provision in no way limits the Contractor's legal obligations to report subcontractors and labor/material suppliers under W. Va. Code § 5-22-1(f) and obtain approval under W. Va. Code § 5-22-1(g) prior to any subcontractor substitution.

- §5.4 Contingent Assignment of Subcontracts: This section is removed in its entirety and replaced with the following:
- §5.4 Emergency Contracts with Subcontractors:

In the event that the general contractor fails to fulfill its contractual obligations and the performance bond has failed to provide an adequate remedy. Owner has the right to execute emergency contracts with subcontractors to ensure continuation of the work, provided that doing so is in compliance with the laws, rules, and procedures governing emergency contracting authority for Owner, and the emergency contract terms comply with all other applicable laws, rules, and procedures.

# ARTICLE 7 CHANGES IN THE WORK

#### §7.1 General

§7.1.2. In Section 7.1.2. remove the word "alone" and insert "with approval by the Owner."

# §7.2 CHANGE ORDERS

- §7.2 Add the following Section to 7.2:
  - §7.2.2 A written Change Order as defined under 7.2.1 above constitutes a final settlement of all matters relating to the change in the Work which is the subject of the Change Order, including, but not limited to general conditions, all direct or indirect costs associated with such change and any and all adjustment to the Contract Sum and Contract Time. The parties also understand and agree that if Owner is a state agency, change orders may require approval by entities in addition to Owner. Those entities may include, but are not limited to, the West Virginia Purchasing Division, and the West Virginia Attorney General's Office. Owner

and Contractor must discuss the change order approval requirements prior to executing this agreement.

Add the following section to § 7.2

- §7.2.3. Allowance for Overhead and Profit: Contractor's overhead and profit for a change order issued under this Article included in the total cost to the Owner shall not exceed based on the following schedule:
  - .1 For the Contractor, for any Work performed by the Contractor's own forces, lifteen percent (15%) of the cost.
  - .2 For the Contractor, for Work performed by the Contractor's Subcontractor, ten percent (10%) of the amount due the Subcontractor.
  - .3 For each Subcontractor or Sub-Subcontractor involved, for any Work performed by that Subcontractor's own forces, fifteen percent (15%) of the cost.
  - .4. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, ten percent (10%) of the amount due the Sub-subcontractor.
  - .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7. Estimated labor hours shall include hours only for those workmen and working foremen directly involved in performing the Change Order work. Supervision above the level of working foremen (such as general foremen, superintendent, project manager, etc.) is considered to be included in the allowance for Overhead and Profit. Hand tools are defined as equipment with a value of \$1,000 or less. For Contractor owned equipment, the "bare" equipment rental rates allowed to be used for pricing Change Order proposals shall be not more than the monthly rate listed in the most current publication of The AED Green Book divided by 176 to arrive at a maximum hourly rate to be applied to the hours the equipment is used performing the Change Order work.
  - .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, material, equipment and Subcontractors. Details to be submitted will include detailed line item estimates showing detailed materials quantity take-offs, material prices by item and related labor hour pricing information and extensions (by line item or by drawing as applicable.) Where major cost items are Subcontracts, they shall also be itemized as prescribed above. In no case will a change involving over \$10,000 be approved without such an itemization.
  - .7 Local Business and Occupation Taxes, if applicable, shall be calculated on the cost of the Work, overhead and profit.

- .8 Overhead and profit shall not be calculated on changes in the Work involving unit prices. Unit prices are to have overhead and profit included in the price quoted.
- .9 Under no circumstances is Contractor permitted to charge for the passage of time (often referred to as general conditions or winter conditions) without an identified, Itemized, and concretely provable cost borne by Contractor. Contractor has a duty to mitigate costs during a delay period to the fullest extent possible and Contractor will not be paid for costs that could have been mitigated. Calculating a daily delay rate without properly identifying, itemizing, and proving actual, unmitigateable costs, is prohibited. Contractor understands and accepts that it has the responsibility to prove that costs could not be mitigated prior to submitting a request for payment.

# **57.3 CONSTRUCTION CHANGE DIRECTIVES**

§7.3.4 Make the following change in Section 7.3.4:

In the fourth line of the first sentence, delete the words "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" and substitute "an allowance for overhead and profit in accordance with clauses 7.3.11.1 through 7.3.11.9 below."

- §7.3.7 Delete the word "recorded" and replace it with "processed".
- §7.3.9 Delete Section 7.3.9 in its entirety and substitute the following:
  - §7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment provided these amounts have been added to the Contract by Change Order and a purchase order has been issued for the Change Order.
- §7.3.10 Add the following sentence to the end of Section 7.3.10:

The Parties will utilize their best efforts to issue a change order within 60 days of agreement being reached, but failure to do so will not give rise to grounds for contract cancellation, penalties, or any other cause of action.

Add the following Section to 7.3:

- §7.3.11 In Section 7.3.7, the allowance for overhead and profit for a change directive issued under this Article included in the total cost to the Owner shall not exceed the following schedule:
  - .1 For the Contractor, for any Work performed by the Contractor's own forces, fifteen percent (15%) of the cost.

- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, ten percent (10%) of the amount due the Subcontractor.
- .3 For each Subcontractor or Sub-Subcontractor involved, for any Work performed by that Subcontractor's own forces, fifteen percent (15%) of the cost.
- .4. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, ten percent (10%) of the amount due the Sub-subcontractor.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7. Estimated labor hours shall include hours only for those workmen and working foremen directly involved in performing the Change Order work. Supervision above the level of working foremen (such as general foremen, superintendent, project manager, etc.) is considered to be included in the allowance for Overhead and Profit. Hand tools are defined as equipment with a value of \$1,000 or less. For Contractor owned equipment, the "bare" equipment rental rates allowed to be used for pricing Change Order proposals shall be not more than the monthly rate listed in the most current publication of The AED Green Book divided by 176 to arrive at a maximum hourly rate to be applied to the hours the equipment is used performing the Change Order work.
- .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, material, equipment and Subcontractors. Details to be submitted will include detailed line item estimates showing detailed materials quantity take-offs, material prices by item and related labor hour pricing information and extensions (by line item or by drawing as applicable.) Where major cost items are Subcontracts, they shall also be itemized as prescribed above. In no case will a change involving over \$10,000 be approved without such an itemization.
- .7 Local Business and Occupation Taxes, if applicable, shall be calculated on the cost of the Work, overhead and profit.
- .8 Overhead and profit shall not be calculated on changes in the Work involving unit prices. Unit prices are to have overhead and profit included in the price quoted.
- .9 Under no circumstances is Contractor permitted to charge for the passage of time (often referred to as general conditions or winter conditions) without an identified, itemized, and concretely provable cost borne by Contractor. Contractor has a duty to mitigate costs during a delay period to the fullest extent possible and Contractor will not be paid for costs that could have been mitigated. Calculating a daily delay rate

without properly identifying, itemizing, and proving actual, unmitigateable costs, is prohibited. Contractor understands and accepts that it has the responsibility to prove that costs could not be mitigated prior to submitting a request for payment.

§7.4 Minor Changes in Work. Insert the following sentence at the end of section 7.4:

"Contractor may request that Architect provide written confirmation that Owner has agreed to the minor change, and if requested, Architect will provide it."

# ARTICLE 8

# §8.3 DELAYS AND EXTENSIONS OF TIME

§8.3.1 In the first sentence, delete "unusual delay in deliveries," and add "unmitigatable costs attributable to" before the words "adverse weather conditions."

# ARTICLE 9 PAYMENTS AND COMPLETION

# 69.1 Contract Sum

§9.1.2 Add the following sentence to the end of section 9.1.2:

"Any equitable adjustment of unit prices must be processed as a change order to the contract"

#### **89.2 SCHEDULE OF VALUES**

§9.2 Make the following changes to Section 9.2:

In the first sentence add "and the Owner" after the first reference to the Architect. In the second sentence add "or the Owner" after Architect. Remove the last sentence in its entirety and replace it with the following:

"Any changes to the schedule of values shall be submitted to the Architect and the Owner and supported by such data to substantiate its accuracy as the Architect or owner may require. This schedule, unless objected to by the Architect or the Owner, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment."

# §9.3 APPLICATIONS FOR PAYMENT

§9.3 Make the following changes to Section 9.3:

§9.3.1 In the first sentence add "and the Owner" after the first reference to the Architect and add "and other required documents" after the words "schedule of values."

- §9.3.1.1 Delete clause 9.3.1.1 in its entirety and substitute the following:
  - §9.3.1.1 Such applications may include requests for payment on account of changes in the Work authorized by Construction Change Directives and Change Orders only after a purchase order has been issued for the Work affected.

## §9.3.1 Add the following clauses to Section 9.3.1:

- §9.3.1.3 Until the Work is fifty percent (50%) complete, the Owner will withhold as retainage 10% of the amount due the Contractor on account of progress payments. At the time the Work is fifty percent (50%) complete and thereafter, if the manner of completion of the Work and its progress are and remain satisfactory to the Owner and Architect, and in the absence of other good and sufficient reasons, the Architect will, on presentation by the Contractor of Consent of Surety, authorize any remaining partial payments to be paid in full.
- §9.3.1.4 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Owner and Architect, if the Surety withholds its consent, or for other good and sufficient reasons.

# §9.4 CERTIFICATES FOR PAYMENT

§9.4.1 After the phrase "in the full amount of the Application for Payment," insert the phrase "less any retainage withheld pursuant to section 9.3.1.3,".

#### **§9.6 PROGRESS PAYMENTS**

- §9.6.7 Delete Section 9.6.7 in its entirety.
- §9.6.8 Delete Section 9.6.8 in its entirety.

#### **§9.7 FAILURE OF PAYMENT**

§9.7 Make the following changes in Section 9.7:

In line two, change "seven days" to "sixty days." In line four, delete "binding dispute resolution" and substitute "the West Virginia Claims Commission"

## \$9.8 SUBSTANTIAL COMPLETION

§9.8.3 Add the following clause to Section 9.8.3:

If Architect is required to perform more than one inspection under this subsection, Contractor shall be responsible for paying the Owner for the cost of the additional inspection, which will be paid by Owner to Architect, at the hourly rate established in the contract between Owner and Architect.

# \$9.8.5 Add the following clause to Section 9.8.5:

§9.8.5.1 The payment of retainage shall be sufficient to increase the total payments to ninety-five percent (95%) for the Work or designated portion thereof being accepted as Substantially Complete, less any amounts as the Architect shall determine for any Work that is not complete, not in accordance with the Contract Documents, or for unsettled claims.

# §9.10 FINAL COMPLETION AND FINAL PAYMENT

\$9,10.1 Add the following to the end of Section 9.10.1:

If Architect is required to perform more than one inspection under this subsection, Contractor shall be responsible for paying the Owner for the cost of the additional inspection, which will be paid by Owner to Architect, at the hourly rate established in the contract between Owner and Architect.

\$9.10.2 Make the following changes in Section 9.10.2:

In the first sentence, delete "for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner)."

Add the following clause to Section 9.10.2:

§9.10.2.1 Before final payment is due the Contractor, all applicable State and local taxes must be paid. If requested by the Owner, the Contractor shall present evidence that payment or satisfaction of all such tax obligations has been made.

§9.10.3 Add the following clause to Section 9.10.3:

9.10.3.1 Unless and to the extent final completion is delayed through no fault of the Contractor as provided in Section 9.10.3, the Owner shall be under no obligation to increase payments above ninety-five percent (95%) until final completion of the Work is Certified by the Architect.

§9.10.4 Make the following changes in Section 9.10.4:

In the first sentence, delete the word "the" and replace it with "Unless and until the Contractor makes a subsequent Claim against the Owner, the".

Add the following as the last sentence. "Neither the Owner's offer of a final payment nor its acceptance by the Contractor shall legally prevent or limit the Owner's right to assert any and all counterclaims in litigation filed by the Contractor as allowed in section 15.1.8."

Add the following Sections to Article 9:

# \$9.11 LIQUIDATED DAMAGES

§9.11.1 The Owner will suffer financial loss if the Work is not Substantially Complete within the Contract Time as defined in Article 8, and if final completion is not achieved within the specified time frame following Substantial Completion. As liquidated damages, and not as a penalty, the Contractor and the Contractor's surety shall be liable for and shall pay the Owner the sum(s) stated in this Agreement and/or purchase order.

§9.11.2 Allowances may be made for delays due to shortages of materials and/or energy resources, subject to proof by documentation, and also for delays due to strikes or other delays beyond the control of the Contractor. All delays and any claim for extension of Contract Time must be properly documented in accordance with Section 15.1.5 by the Contractor and must be made within the time limits stated in Section 15.1.2.

# ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

# §10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

§10.2.8 Make the following changes to Section 10.2.8:

In the first sentence, delete "within a reasonable time not exceeding 21 days" and substitute "immediately".

# §10.3 HAZARDOUS MATERIALS

§10.3.3 Delete Section 10.3.3 in its entirety.

# ARTICLE 11 INSURANCE AND BONDS

#### §11.1 CONTRACTOR'S LIABILITY INSURANCE

§11.1.2 Add the following to the end of §11.1.2.

At a minimum the Contract shall provide, at the Contractor's Expense:

§11.1.2.1. a Performance Bond and a Labor and Material Payment Bond for 100% of the Contract Sum and, if applicable, a two-year roofing Maintenance Bond for the full value of the roofing system.

§11.1.2.2 An attorney-in-fact who executes the bonds on behalf of the surety shall affix thereto a certified and current copy of power of attorney.

§11.1.2.3 The bonds shall be issued on State of West Virginia forms. The Contractor shall deliver the required bonds and all other contract documents to the Owner not later than 15 days following receipt of the Owner's notice of intent to award a Contract.

511.2 Owner's Insurance Delete section 11.2 in its entirety.

§11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

§11.4 Section 11.4 is deleted in its entirety.

\$11.5.1 Make the following changes in Section 11.5.1:

In the first sentence, substitute "Contractor" for "Owner" each time the latter word appears.

§11.5.2 Delete Section 11.5.2 in its entirety and substitute the following:

§11.5.2 Prior to settlement of insured loss, the Contractor shall notify the parties of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The parties shall have 14 days from the receipt of notice to object. If no objection is made, the Contractor shall proceed as proposed and allocate the settlement accordingly. If such objection is made, the dispute shall be resolved as provided in Section 15.4. The Contractor, in that case, shall make settlement with insurers in accordance with directions of the Court. If distribution of the insurance proceeds as directed by the Court is required, the Court will direct such distribution. Any work to repair the damage will be incorporated into the contract as a change order.

# ARTICLE 13 MISCELLANEOUS PROVISIONS

#### §13.4 TESTS AND INSPECTIONS

§13.4.1 Remove the phrase "so require" and insert in its place "prohibit delegation of the test to Contractor"

#### §13.6 INTEREST

§13.6 Delete Section 13.5 in its entirety and substitute the following:

Notwithstanding any other provision in the Contract Documents, West Virginia Code does not authorize the payment of interest on late payments. Accordingly, interest charges for late payment are prohibited.

Add the following Sections to Article 13:

#### §13.6 WORKERS COMPENSATION

The Contractor shall provide proof of compliance with West Virginia Worker's Compensation laws and regulations.

## §13.7 CONTRACTOR'S LICENSE

§13.7.1 West Virginia Code §21-11-2 requires that all persons desiring to perform contractual work in West Virginia shall be duly licensed. The West Virginia Contractor's Licensing Board is empowered to issue a contractor's license.

§13.7.2 West Virginia Code §21-11-11 requires any prospective Bidder to include the Bidder's contractor's license number on its Bid. The successful Bidder will be required to furnish a copy of its contractor's license in a classification appropriate to the Work prior to issuance of a purchase order/contract.

# ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

# §14.1 TERMINATION BY THE CONTRACTOR

§14.1.1 Make the following changes in Section 14.1.1:

At the end of clause 14.1.1.3 delete "; or" and insert a period.

Delete clause 14.1.1.4 in its entirety.

§14.1.3 Delete Section 14.1.3 In its entirety and substitute the following:

§14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exist, the Contractor may, upon seven days written notice to the Owner and Architect, terminate the Contract. In such event, the Contractor shall be paid for all Work performed in accordance with the Contract Documents, for reasonable and proven termination expenses and a reasonable allowance for overhead and profit. However, such payment, exclusive of termination expenses, shall not exceed the Contract Sum as reduced by other payments made to the Contractor and further reduced by the value of Work as yet not completed. The Contractor shall be entitled to reasonable overhead, but not profit, on Work not performed.

#### §14.2 TERMINATION BY THE OWNER FOR CAUSE

§14.2.4 Delete Section 14.2.4 in its entirety and substitute the following:

§14.2.4 If the unpaid balance of the Contract Sum exceeds the cost 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 not 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 Owner shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

# **814.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

\$14.4.1 Delete Section 14.4.1 in its entirety and substitute the following:

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

\$14.4.3 Delete Section 14.4.3 in its entirety and substitute the following:

§14.4.3 in case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Section 14.1.3 above.

Add the following Section to Article 14:

# §14.5 FISCAL YEAR FUNDING

§14.5 Work performed under this Contract is to continue in the succeeding fiscal year contingent upon funds being appropriated by the Legislature for this Work. In the event funds are not appropriated for this Work, this Contract becomes of no effect and is null and void after June 30.

# ARTICLE 15 CLAIMS AND DISPUTES

# §15.1 Claims

# §15.1.2 TIME LIMITS ON CLAIMS

§15.1.2 Delete Section 15.1.2 in its entirety and substitute the following:

Any applicable statute of limitations shall be in accordance with West Virginia Code.

§15.1.3 NOTICE OF CLAIMS Add the following to § 15.1.3:

§15.1.3.3 All claims, and notice of claims that require an increase in contract time, contract scope, or contract sum must be made in writing.

§ 15.1.8 is added to the Contract as follows:

§ 15.1.8 Counterclaims – In the event that Contractor makes a claim, Owner reserves the right to make a counterclaim and will not be barred from doing so even if final payment has been made.

# §15.2 INITIAL DECISION

§15.2.1 In the third sentence of Section 15.2.1, insert "or litigation" following the word "mediation" and remove the phrase "binding dispute resolution" and replace it with "or litigation".

§15.2.5 Delete the last sentence in Section 15.2.5 and substitute the following:

Approval or rejection of a claim by the Initial Decision Maker shall be final and binding on the parties unless it is pursued further by either party in accordance with Section 15,2.6.

§15.2.6 Make the following change to clause 15.2.6.1:

In the last sentence, delete "or pursue binding dispute resolution proceedings."

\$15.2.8 Delete Section 15.2.8 in its entirety.

# §15.3 MEDIATION

§15.3.1 Delete "binding dispute resolution" and substitute "litigation in a court of competent jurisdiction."

§15.3.2 Delete Section 15.3.2 in its entirety and substitute the following:

§15.3.2 The parties shall endeavor to resolve their Claims by non-binding 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.

§ 15.3.3 Remove section 15.3.3 in its entirety

## 615.4 ARBITRATION

§15.4 Delete Section 15.4 in its entirety and substitute the following:

# §15.4 SETTLEMENT OF CLAIMS

§15.4.1 The Constitution of West Virginia grants the State sovereign immunity from any and all Claims against the public treasury. This immunity applies and is extended to all agencies of the State, including the Owner. It shall be in full force and effect as it relates to this Contract. The West Virginia Legislature, recognizing that certain Claims against the State may constitute a moral obligation of the State and should be heard, has established the West Virginia Claims Commission for this purpose. The Parties understand that this sovereign immunity and the Constitution of the

State of West Virginia prohibit the State and Owner, from entering into binding arbitration. Notwithstanding any provision to the contrary in the Contract Documents, all references to arbitration, regardless of whether they are included in the AIA Document A201-2017 or another related document are hereby deleted and all Claims of the Contractor for monetary relief, and only of the Contractor, arising out of or related to this Contract shall be decided by the West Virginia Claims Commission. The following Sections have been rewritten to bring them into conformance with the foregoing.

§15.4.2 Claims by the Owner may be brought against the Contractor in the Circuit Court of Kanawha County, West Virginia, or in any other court that has jurisdiction, as the Owner may elect.

§15.4.3 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 15.1.6, 9.10.4 and 9.10.5, shall, within 30 days after submission of the decision by the Initial Decision Maker, be settled for the Contractor by the West Virginia Claims Commission or, for the Owner, by the Circuit Court of Kanawha County or any other court of jurisdiction as the Owner may elect.

§15.4.4 Notice of such action shall be filed in writing with the other party to the Contract, and a copy of such notice shall be filed with the Initial Decision Maker and the Architect, if applicable.

§15.4.5 During court proceedings, the Owner and the Contractor shall comply with Section 15.1.3.

§15.4.6 Claims shall be made within the time limits specified in Section 15.2.6.1.

§15.4.7 The party filing a Claim must assert in the demand all Claims then known to that party on which action is permitted.

Add the following Article:

# ARTICLE 16 EQUAL OPPORTUNITY

§16.1 COMPLIANCE WITH REGULATIONS UNDER TITLE VI OF THE FEDERAL CIVIL RIGHTS ACT OF 1964 AND EXECUTIVE ORDER 65-2 BY THE GOVERNOR OF WEST VIRGINIA DATED DECEMBER 15, 1965

§16.1.1 The Contractor agrees that it will comply with Title VI of the Federal Civil Rights Act of 1964 (P.L. 88352) and the regulations of the State of West Virginia, to the end that no person in the State, or in the United States, shall on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or otherwise subjected to discrimination under any program or activity for which the Contractor receives any recompense or other consideration of value, either directly or indirectly from the State; and HEREBY GIVES ASSURANCE THAT it will immediately take any measures necessary to effectuate this Agreement.

§16.1.2 If any real property or structure thereon is provided or improved, this assurance shall obligate the Contractor, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which any State payment is extended or for another purpose involving the provision of similar services or benefits. If any other goods or services are so provided, this assurance shall obligate the Contractor for the period during which it supplies such goods or services.

§16.1.3 The Contractor recognizes and agrees that such right to provide property, goods or services to the State will be extended in reliance on the representations and agreements made in assurance, and that the State shall have the right to seek judicial enforcement of this assurance. This is binding on the Contractor, its successors, transferee, and assignee, or any authorized person on behalf of the Contractor.

END OF SUPPLEMENTARY CONDITIONS TO AIA DOCUMENT A201-2017

AIA A201-2017 Supplementary	Conditions to Standard form of Agreemer	it Between
Owner and Contractor		

State of West Virginia

Any provisions of the Contract Documents that conflict with these Supplementary Conditions shall be null and void unless they have been approved in writing by the applicable State purchasing officer and the Attorney General, and are clearly identified as such in the bid documents.

The Owner and Contractor hereby agree to the full performance of the covenants contained herein.

IN WITNESS WHEREOF, the Owner and Contractor have entered into this Agreement as of the effective date as stated in the A101-2017 (when utilized) or other Contract Documents.

Owner:	General Services Division	Contractor: DSO Mechanical LLC
Ву:	James R Jones	Ву:
Title:	Procurement Administrator	Title: CHIEF EXECUTIVE OFFICE
Date:	5/3/2023	Date: 4/27/23

This Supplementary Conditions to AIA Document A201-2017, General Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 and 1905 and 1905 and 1905 and 1905 are supplementary Conditions to AIA Document A201-2017, General Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 and 1905 are supplementary Conditions to AIA Document A201-2017, General Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 and 1905 are supplementary Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 and 1905 are supplementary Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 and 1905 are supplementary Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 are supplementary Conditions of the Contract for Construction, has been approved as to form on this 2012 day of 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Conditions of the Contract for Construction and 1905 are supplementary Contract for Construction and 1905 are supplementary Contract for Contract for Construction and 1905 are supplementary Contract for Contract for

PATRICK MORRISEY, ATTORNEY GENERAL

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# **SPECIFICATIONS**





# WV STATE CAPITOL COMPLEX

Charleston, WV

Building 3
Hydronic Boiler System Upgrades

**ZDS Project** #GSD-221-C

**GSD Procurement Folder** #GSD1176204

January 9, 2023



135 Corporate Center Drive / Suite 532 Scott Depot, WV 25560 (304) 755-0075 / www.ZDSDesign.com

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**GSD-221-C** 

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GSD-221-C	Hydronic Boiler System Upgrades

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END OF DRAWING SCHEDULE

# PROJECT PERSONNEL

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Scot Casdorph, Architectural/Engineering Manager

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Charleston, WV 25305 Phone: (304) 352-5518 Scot.R.Casdorph@wv.gov

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# CONTRACT DOCUMENTS



# General Conditions of the Contract for Construction

#### for the following PROJECT:

(Name and location or address)

WV State Capitol Complex Building 3 Hydronic Boiler System Upgrades

#### THE OWNER:

(Name, legal status and address)

WV General Services Division 103 Michigan Avenue Charleston, WV 25311 Telephone Number: 304-558-2317

#### THE ARCHITECT:

(Name, legal status and address)

ZDS Design/Consulting Services ZDS is the Engineer of Record for this project. In all locations of this and attached forms, delete "Architect" and add "Engineer" 135 Corporate Center Drive, Suite 532 Scott Depot, WV 25560

Telephone Number: 304-755-0075

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#### 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.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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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 or proposal 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. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

# § 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.

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- § 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.
- § 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 retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and 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 the 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 suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, 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 suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

#### § 1.6 Notice

- § 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.
- § 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

#### § 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203TM\_2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

#### § 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203TM\_2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202<sup>TM</sup>–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

#### 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 Evidence of the Owner's Financial Arrangements

- § 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.
- § 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.
- § 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.
- § 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

#### § 2.3 Information and Services Required of the Owner

- § 2.3.1 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.
- § 2.3.2 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.

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- § 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.
- § 2.3.4 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.
- § 2.3.5 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.
- § 2.3.6 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.

# § 2.4 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.

#### § 2.5 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 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 default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for 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. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

#### 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 its 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 2.3.4, 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 submit 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, subject to Section 15.1.7, 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be 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 notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative 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 approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 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

- § 3.5.1 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.
- § 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

#### § 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 14 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 that an equitable adjustment be made 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, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim 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 notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice 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 and Submittal Schedules

- § 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.
- § 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably 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, or fails to provide submittals in accordance with the approved 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 make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

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 how 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 the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect 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 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.
- § 3.12.10.1 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 be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately 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 and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and 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.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

#### § 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, 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, or patching shall be restored to the condition existing prior to the cutting, fitting, or 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 construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its 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 and 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 the Owner shall be entitled to reimbursement from the Contractor.

# § 3.16 Access to Work

The Contractor shall provide the Owner and Architect with 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 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 an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the 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 Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.
- § 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.

#### § 4.2 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.
- § 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 promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) 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

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

- § 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 13.4.2 and 13.4.3, whether or not the 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, 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 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 order 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 Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.
- § 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 the 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, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice 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 for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

#### § 5.3 Subcontractual Relations

By appropriate written agreement, 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 that the Contractor, by these Contract 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
  - 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; 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 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 term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.
- § 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 any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its 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 or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has 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 notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work 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. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.
- § 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 that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor 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. The Contractor shall proceed promptly with changes in the Work, 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:
  - 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:
  - Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to .1 permit evaluation;
  - 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
  - As provided in Section 7.3.4.
- § 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine 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 7.3.4 shall be limited to the following:

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- .1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
- .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, directly related to the change; and
- .5 Costs of supervision and field office personnel directly attributable to the change.
- § 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.
- § 7.3.6 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.
- § 7.3.7 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.
- § 7.3.8 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 may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

#### 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, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.
- § 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 (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended 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

- § 9.1.1 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.
- § 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

#### § 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent 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. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and 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.

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- § 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 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, suppliers, or other persons or entities that 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 (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole 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 in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. 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. 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 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
  - 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 suppliers 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;
- 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 either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.
- § 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.
- § 9.5.4 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 supplier to whom the 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 Contractor shall reflect such payment on its next Application 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 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 and suppliers 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 or supplier, except as may otherwise be required by law.
- § 9.6.5 The Contractor's payments to 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 or provided by 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, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.
- § 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

# § 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' 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 shutdown, 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; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and 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 the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the 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 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.

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§ 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 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. 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 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, (3) a written statement that the Contractor knows of no 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, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and 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, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance 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 the lien, claim, security interest, or encumbrance, 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, corrected, 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 the 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;
  - .3 terms of special warranties required by the Contract Documents; or
  - .4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.
- § 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a 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

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- .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, a Subcontractor, or a Sub-subcontractor; 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 implement, 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 the owners and users of adjacent sites and utilities of the safeguards.
- § 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. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is 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, notice of the 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 and Substances

- § 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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 notify the Owner and Architect of the condition.
- § 10.3.2 Upon receipt of the Contractor's 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 the material or substance or who are to perform the task of removal or safe containment of the 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 by the amount of the Contractor's reasonable additional costs of shutdown, 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 hazardous 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 hazardous 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 reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances 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 reimburse 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 Insurance and Bonds

- § 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.
- § 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.
- § 11.1.3 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.
- § 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act

or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

# § 11.2 Owner's Insurance

- § 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.
- § 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.
- § 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

#### § 11.3 Waivers of Subrogation

- § 11.3.1 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; (2) the Architect and Architect's consultants; and (3) Separate Contractors, 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 those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.
- § 11.3.2 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, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.
- § 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

#### §11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement 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 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

#### UNCOVERING AND CORRECTION OF WORK ARTICLE 12

§ 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, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

#### § 12.2 Correction of Work

#### § 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before 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 any 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 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 2.5.

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- § 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 of the Owner or Separate Contractors, whether completed or partially completed, 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, excluding that jurisdiction's choice of law rules. 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 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 the assignment.

#### § 13.3 Rights and Remedies

- § 13.3.1 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.
- § 13.3.2 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 thereunder, except as may be specifically agreed upon in writing.

#### § 13.4 Tests and Inspections

§ 13.4.1 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

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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 tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

- § 13.4.2 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 13.4.1, 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 13.4.3, shall be at the Owner's expense.
- § 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 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.
- § 13.4.4 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.
- § 13.4.5 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.
- § 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties 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.

#### 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, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, 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 reasonable evidence as required by Section 2.2.
- § 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, 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' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work 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' 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 or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .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 reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner 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' 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 under 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 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 Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

#### 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, a change in the Contract Time, 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. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

#### § 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the 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 15.1.2.

#### § 15.1.3 Notice of Claims

- § 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by 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 under this Section 15.1.3.1 shall 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.
- § 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

#### § 15.1.4 Continuing Contract Performance

- § 15.1.4.1 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.
- § 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

#### § 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### § 15.1.6 Claims for Additional Time

- § 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 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.
- § 15.1.6.2 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.

#### § 15.1.7 Waiver of 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
- 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 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

#### § 15.2 Initial Decision

- § 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, 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. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a 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 the 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 receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, 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 15.1.7, 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 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.
- § 15.3.4 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.

#### § 15.4 Arbitration

- § 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.
- § 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.
- § 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.
- § 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

**User Notes:** 

#### § 15.4.4 Consolidation or Joinder

- § 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party 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 those of the Owner and Contractor under this Agreement.

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**User Notes:** 

#### State of West Virginia

# Supplementary Conditions to AIA Document A201-2017 General Conditions of the Contract for Construction

The following Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

Order of Precedence: The documents contained in the contract to which this document has been attached shall be interpreted in the following order of precedence:

First Priority – Documents developed by the State or agency and utilized to provide public notice of the solicitation, along with other general terms and conditions shall be first in priority.

Second Priority – This document "Supplementary Conditions to the AIA Document A201-2017 General Conditions of the Contract for Construction" shall be second in priority.

Third Priority – all other AIA documents including, but not limited to, the AIA Document A201-2017 General Conditions of the Contract for Construction and the A101-2017 Standard Form of Agreement Between Owner and Contractor (when utilized) shall be third or lower in priority.

# ARTICLE 1 GENERAL PROVISIONS

Add the following Section to Article 1:

#### §1.05 PARTY RELATIONS

§1.05 The Owner and their consultants, the Architect and their Consultants, and the Contractor and their Subcontractors agree to proceed with the Work on the basis of mutual trust, good faith and fair dealing.

#### §1.1 BASIC DEFINITIONS

#### §1.1.1 THE CONTRACT DOCUMENTS

# §1.1.1 Delete the last sentence of this Section and substitute the following:

The Contract Documents also include the Bidding Documents (Advertisement or Invitation to Bid, Request for Quotations/Bids, Instructions to Bidders, Form of Proposal, Bid Bond and Sample Forms), Performance Bond, Payment Bond, Maintenance Bond (if applicable), Certificates of Insurance, Special Provisions For Disadvantaged and Women Business Enterprise Utilization (if bound herein).

#### §1.1.2 THE CONTRACT

#### §1.1.2 Make the following changes to Section 1.1.2:

In the last sentence, insert "and the Contractor" after "The Architect" and delete "the Architect's" and insert "their respective".

#### §1.2 Correlation and intent of Contract Documents

§1.2.1.1 In the second sentence, remove "any law" and insert "West Virginia law or any applicable federal law". In the last sentence, remove "by law" and insert "West Virginia law or any applicable federal law".

#### §1.7 Digital Data Use and Transmission

§1.7 Delete the last sentence of this section in its entirety.

#### §1.8 Building Information Models Use and Reliance

§ 1.8 Remove this section in its entirety and replace it with the following:

"Any use of, or reliance on, all or a portion of a building information model must be approved in advance by Owner and will only be permitted if the Parties have agreed upon and executed written documents to memorialize protocols governing the use of, and reliance on, the information contained in the model."

# ARTICLE 2 OWNER

§2.1 GENERAL

§ 2.1.1 Add the following after the last sentence:

Notwithstanding the foregoing, the parties understand that since Owner is a government entity, change orders will often require approval by entities in addition to owner. When owner is a state agency, those entities may include, but are not limited to, the West Virginia Attorney General's Office and the West Virginia Purchasing Division.

Additionally, approval may be required by agencies providing project funding, including but not limited to, West Virginia School Building Authority and agencies of the United States federal government.

- §2.1.2 Delete Section 2.1.2 in its entirety.
- §2.1 Add the following Section to 2.1:

§2.1.3 The Owner and the agency funding the project reserve the right to maintain a full time or part time project representative (sometimes referred to as the "Clerk of the Works") at the project site who shall keep the Owner informed of the progress and quality of the Work and responsibilities. The Contractor shall cooperate and assist the Clerk of the Works in the performance of his/her duties. The Clerk of the Works will not interfere with or be responsible for the Contractor's supervision and direction of the Work, and the Contractor's means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work. The Clerk of the Works may facilitate communications between the Owner, Architect, and Contractor but has no authority to make decisions for the Owner, approve modifications to the Contract Documents, the Contract Time, or Contract Sum. Additionally, Contractor is not permitted to rely on or consider decisions made by the Clerk of the Works on behalf of Owner

§2.2 Evidence of the Owner's Financial Arrangements: Delete § 2.2 and all of its subsections in its entirety.

#### §2.3 Information and Services Required of Owner

§2.3.2 Make the following changes to Section 2.3.2:

In first sentence, delete the period and add ", when required pursuant to West Virginia Code §30-12-1 et seq." Add the following sentence at the end of Section 2.3.2: "If the Owner does not retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located, the Owner will appoint an individual to assume the role and obligations of the Architect pursuant to this Agreement."

§2.3.3 Delete this section in its entirety.

§2.3.4 Delete the last sentence of Section 2.3.4 and substitute the following:

The Contractor shall confirm the locations of each utility. If the Owner has provided geotechnical and other tests to determine subsurface conditions, the Owner will provide such documents to the Contractor; the Contractor acknowledges that it will make no claims for any subsurface or any other conditions revealed by these tests.

# ARTICLE 3 CONTRACTOR

# §3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§3.2.2 Add the following sentence to the end of Section 3.2.2:

Claims by Contractor resulting from its failure to familiarize itself with the site shall be deemed waived. Additionally, by submitting a bid or otherwise entering into this contract, Contractor acknowledges that it has reviewed and understands the contract documents and the work required by those documents. Any claims arising from Contractor's failure to review and understand the contract documents shall be deemed waived.

- §3.2.3 Delete Section 3.2.3 in its entirety and substitute the following:
  - §3.2.3 The Contractor acknowledges its continuing duty to review and evaluate the Construction Documents during performance of its services and shall immediately notify the Owner and the Architect about any problems, conflicts, defects, deficiencies, inconsistencies or omissions it discovers in or between the Construction Documents; and variances it discovers between the Construction Documents and applicable laws, statutes, building codes, rules and regulations.
- § 3.2.4 Add the following clauses to Section 3.2.4:
  - §3.2.4.1 If the Contractor performs any Work which it knows or should have known involves a recognized problem, conflict, defect, deficiency, inconsistency or omission in the Construction Documents; or a variance between the Construction Documents and requirements of applicable laws, statutes, building codes, rules and regulations, without notifying the Owner and the Architect prior to receiving written authorization from the Architect to proceed, the Contractor shall be responsible for the consequences of such performance.
  - §3.2.4.2 Before ordering any materials or doing any Work, the Contractor and Subcontractors shall verify all measurements at the site and shall be responsible for the correctness of same. Discrepancies shall be reported in writing to the Architect prior to proceeding with the Work. No extra charge or compensation will be

entertained due to differences between actual measurements and dimensions indicated on the drawings, if such differences do not result in a change in the scope of Work or if the Architect failed to receive written notice before the Work was performed.

#### §3.4 LABOR AND MATERIALS

§3.4.1 Vendor must review and comply with the following statutory requirements affecting public construction projects, as well as any other applicable laws that are not referenced herein:

- W. Va. Code § 5-19-1 et seq., relating to domestic steel preference.
- W. Va. Code § 5A-3-56 relating to domestic steel preference, provided that the Owner is a state agency subject to Chapter 5A. Article 3 of the W. Va. Code.
- W. Va. Code § §21-1C-1 et seq., relating to local hiring preference
- W. Va. Code §21-1D-1 et seq., relating to drug free workplace requirements.

#### §3.4 Add the following Sections to 3.4:

§3.4.4 Where materials and equipment are to be provided by the Owner under the Contract Documents, the Contractor shall notify the Owner in writing as to when materials and equipment are required on the project site in sufficient time to avoid delay in the Work.

§3.4.5 The Contractor shall employ labor on the Project or in connection with the Work, capable of working harmoniously with all trade crafts and any other individuals associated with the Project. The Contractor shall also use its best efforts and implement policies and practices to minimize the likelihood of any strike, work stoppage or other labor disturbance. Except as specifically provided in this Agreement, Contractor shall not be entitled to any adjustment in the Contract sum or Contract time and shall be liable to the Owner for all damages suffered by the Owner occurring as a result of work stoppages, slowdowns, disputes, or strikes by the work force of or provided by Contractor or its Subcontractors.

#### §3.5 WARRANTY

§3.5 Add the following sentence at the end of Section 3.5:

The Contractor agrees to assign to the Owner at time of Final Completion of the Work, any and all manufacturer's warranties relating to materials and labor used in the Work and further agrees to perform the Work in such a manner so as to preserve any and all such warranties.

#### §3.8 ALLOWANCES

§3.8.3 Make the following change to Section 3.8.3:

§3.8.3 Delete "with reasonable promptness" and insert "in sufficient time to avoid delay in the Work."

Add the following Section to 3.8:

§3.8.4 The Contractor shall promptly submit to the Owner an itemized account of any expenditure by the Contractor of the Contract allowance in sufficient detail to allow the Owner to properly account for such expenditure.

#### **\$3.9 SUPERINTENDENT/PROJECT MANAGER**

§3.9.1 Add the following sentence to the end of Section 3.9.1:

The Contractor may also employ a competent project manager.

§3.9.2 Make the following changes to Section 3.9.2:

In the first sentence, add "and project manager, if applicable" after "superintendent." In the second sentence, add "or project manager, if applicable," after "superintendent."

§3.9.3 Make the following changes to Section 3.9.3:

In the first sentence, add "or project manager, if applicable," after "superintendent." In the second sentence, add "or project manager, if applicable," after "superintendent."

§3.9 Add the following Section to 3.9:

§3.9.4 The Owner shall have the right, at any time, to direct a change in the Contractor's representatives if their performance is deemed unsatisfactory.

#### §3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§3.10.1 Make the following changes to Section 3.10.1:

In the first sentence, delete the word "promptly" and substitute "by the earliest reasonable date".

Add the following sentence to the end of Section 3.10.1: "The Contractor shall submit an updated construction schedule with each payment application, unless waived by the Owner."

Add the following Sections to 3.10:

§3.10.4 At any time after the first thirty (30) days of the Contract Time, if it is found that the project is two (2) weeks or more behind schedule, beyond approved time extensions, or if at any time during

the last thirty (30) days of the scheduled Contract Time the Contractor is one (1) week or more behind schedule, the Contractor shall immediately submit a plan to the Owner describing how the Work will be placed back on schedule within the remaining Contract Time.

\$3,10.5 If the Owner and the Architect determine that the performance of the Work during any stage of the construction schedule last approved by the Owner has not progressed or reached the level of completion required by the Contract Documents, the Owner will have the right to order the Contractor to take corrective measures (hereinafter referred to collectively as Extraordinary Measures) necessary to expedite the progress of the Work, including, without limitation: (1) working additional shifts or overtime: (2) supplying additional manpower, equipment and facilities; and (3) other similar measures. Such Extraordinary Measures shall continue until the progress of the Work complies with the last approved construction schedule. The Owner's right to require Extraordinary Measures is solely for the purpose of ensuring the Contractor's compliance with the construction schedule after allowing for approved extensions of Contract Time as provided elsewhere in this Agreement. The Contractor is not entitled to an adjustment in the Contract Sum in connection with any Extraordinary Measures required by the Owner. The Owner may exercise its rights under this Section as frequently as the Owner deems necessary to ensure that the Contractor's performance of the Work will comply with the construction schedule.

#### §3.11 DOCUMENTS AND SAMPLES AT THE SITE

§3.11 Insert the following sentence at the end of Section 3.11:

The Contractor's compliance with this Section 3.11 shall be a condition precedent to any obligation of the Owner to make Final Payment pursuant to this Agreement.

#### §3.15 CLEANING UP

§3.15.2 Delete Section 3.15.2 in its entirety and substitute the following:

§3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and may withhold such reasonable costs as necessary for the fulfillment of the Contractor's obligation under this Section 3.15. If the reasonable costs of such cleaning exceed the Contract Sum then due the Contractor, the Contractor shall reimburse the Owner the difference within thirty (30) consecutive calendar days of the Owner's written request.

Any materials, tools, supplies, or other personal property left by the Contractor shall be deemed abandoned property and the Owner shall have no obligation to hold or store the property on behalf of Contractor and may dispose of the abandoned property as if it were property of the State of West Virginia. Provided however, that prior to treating property as abandoned and disposing of it, Owner must

first provide Contractor with 10 days notice of its intent to do so. If any materials, tools, supplies or other personal property belong to a subcontractor, then Contractor is obligated to communicate this notice to its subcontractor immediately.

#### §3.15 Add the following Section to 3.15:

§3.15.3 In order to achieve Substantial Completion, as defined by Section 9.8, for any portion of the Work, the Contractor must have the area where the Work is located fully cleaned and all materials and/or debris removed from site. The Certificate of Substantial Completion will not be issued until the Contractor has met this obligation.

# ARTICLE 4 ARCHITECT

#### §4.1 GENERAL

#### §4.2 ADMINISTRATION OF THE CONTRACT

§4.2 Make the following changes to Section 4.2:

§4.2.1 In the first sentence of Section 4.2.1 after the word Architect add ", unless otherwise indicated by the Owner,".

§4.2.2 In the first sentence of Section 4.2.2 strike the word "generally."

 $\S4.2.3$  In the first sentence of Section 4.2.3 strike the word "reasonably."

§4.2.5 Add the following sentence at the end of Section 4.2.5:

The Architect upon receipt of an Application for Payment from the Contractor shall either review and certify such amounts due for payment or return such Application for Payment to the Contractor for correction(s) within five (5) consecutive business days of receipt.

§4.2.7 Delete the first sentence of Section 4.2.7 and substitute the following:

The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples for the purpose of checking for conformance with the Contract Documents.

Modify the second to last sentence by removing it in its entirety and replacing it with the following: The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures, unless the Architect has established the required construction means, methods, techniques, sequences, or procedures, or the Contract Documents require such approval.

§4.2.8 Make the following change to Section 4.2.8:

In the first sentence, after the word Architect add ", in consultation with the Owner,".

# ARTICLE 5 SUBCONTRACTORS

- §5.2 Award of Subcontracts and Other Contracts for Portions of Work
- §5.2.1 Add the following sentence to Section 5.2.1.

This provision in no way limits the Contractor's legal obligations to report subcontractors and labor/material suppliers under W. Va. Code § 5-22-1(f) and obtain approval under W. Va. Code § 5-22-1(g) prior to any subcontractor substitution.

- §5.4 Contingent Assignment of Subcontracts: This section is removed in its entirety and replaced with the following:
- **§5.4 Emergency Contracts with Subcontractors:**

In the event that the general contractor fails to fulfill its contractual obligations and the performance bond has failed to provide an adequate remedy, Owner has the right to execute emergency contracts with subcontractors to ensure continuation of the work, provided that doing so is in compliance with the laws, rules, and procedures governing emergency contracting authority for Owner, and the emergency contract terms comply with all other applicable laws, rules, and procedures.

# ARTICLE 7 CHANGES IN THE WORK

#### §7.1 General

§7.1.2. In Section 7.1.2. remove the word "alone" and insert "with approval by the Owner."

#### §7.2 CHANGE ORDERS

- §7.2 Add the following Section to 7.2:
  - §7.2.2 A written Change Order as defined under 7.2.1 above constitutes a final settlement of all matters relating to the change in the Work which is the subject of the Change Order, including, but not limited to general conditions, all direct or indirect costs associated with such change and any and all adjustment to the Contract Sum and Contract Time. The parties also understand and agree that if Owner is a state agency, change orders may require approval by entities in addition to Owner. Those entities may include, but are not limited to, the West Virginia Purchasing Division, and the West Virginia Attorney General's Office. Owner

and Contractor must discuss the change order approval requirements prior to executing this agreement.

Add the following section to § 7.2

- §7.2.3. Allowance for Overhead and Profit: Contractor's overhead and profit for a change order issued under this Article included in the total cost to the Owner shall not exceed based on the following schedule:
  - .1 For the Contractor, for any Work performed by the Contractor's own forces, fifteen percent (15%) of the cost.
  - .2 For the Contractor, for Work performed by the Contractor's Subcontractor, ten percent (10%) of the amount due the Subcontractor.
  - .3 For each Subcontractor or Sub-Subcontractor involved, for any Work performed by that Subcontractor's own forces, fifteen percent (15%) of the cost.
  - .4. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, ten percent (10%) of the amount due the Sub-subcontractor.
  - .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7. Estimated labor hours shall include hours only for those workmen and working foremen directly involved in performing the Change Order work. Supervision above the level of working foremen (such as general foremen, superintendent, project manager, etc.) is considered to be included in the allowance for Overhead and Profit. Hand tools are defined as equipment with a value of \$1,000 or less. For Contractor owned equipment, the "bare" equipment rental rates allowed to be used for pricing Change Order proposals shall be not more than the monthly rate listed in the most current publication of The AED Green Book divided by 176 to arrive at a maximum hourly rate to be applied to the hours the equipment is used performing the Change Order work.
  - .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, material, equipment and Subcontractors. Details to be submitted will include detailed line item estimates showing detailed materials quantity take-offs, material prices by item and related labor hour pricing information and extensions (by line item or by drawing as applicable.) Where major cost items are Subcontracts, they shall also be itemized as prescribed above. In no case will a change involving over \$10,000 be approved without such an itemization.
  - .7 Local Business and Occupation Taxes, if applicable, shall be calculated on the cost of the Work, overhead and profit.

- .8 Overhead and profit shall not be calculated on changes in the Work involving unit prices. Unit prices are to have overhead and profit included in the price quoted.
- .9 Under no circumstances is Contractor permitted to charge for the passage of time (often referred to as general conditions or winter conditions) without an identified, itemized, and concretely provable cost borne by Contractor. Contractor has a duty to mitigate costs during a delay period to the fullest extent possible and Contractor will not be paid for costs that could have been mitigated. Calculating a daily delay rate without properly identifying, itemizing, and proving actual, unmitigateable costs, is prohibited. Contractor understands and accepts that it has the responsibility to prove that costs could not be mitigated prior to submitting a request for payment.

#### §7.3 CONSTRUCTION CHANGE DIRECTIVES

§7.3.4 Make the following change in Section 7.3.4:

In the fourth line of the first sentence, delete the words "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" and substitute "an allowance for overhead and profit in accordance with clauses 7.3.11.1 through 7.3.11.9 below."

- §7.3.7 Delete the word "recorded" and replace it with "processed".
- §7.3.9 Delete Section 7.3.9 in its entirety and substitute the following:
  - §7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, amounts not in dispute for such changes in the Work shall be included in Applications for Payment provided these amounts have been added to the Contract by Change Order and a purchase order has been issued for the Change Order.
- \$7.3.10 Add the following sentence to the end of Section 7.3.10:

The Parties will utilize their best efforts to issue a change order within 60 days of agreement being reached, but failure to do so will not give rise to grounds for contract cancellation, penalties, or any other cause of action.

Add the following Section to 7.3:

- §7.3.11 In Section 7.3.7, the allowance for overhead and profit for a change directive issued under this Article included in the total cost to the Owner shall not exceed the following schedule:
  - .1 For the Contractor, for any Work performed by the Contractor's own forces, fifteen percent (15%) of the cost.

- .2 For the Contractor, for Work performed by the Contractor's Subcontractor, ten percent (10%) of the amount due the Subcontractor.
- .3 For each Subcontractor or Sub-Subcontractor involved, for any Work performed by that Subcontractor's own forces, fifteen percent (15%) of the cost.
- .4. For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, ten percent (10%) of the amount due the Sub-subcontractor.
- .5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.7. Estimated labor hours shall include hours only for those workmen and working foremen directly involved in performing the Change Order work. Supervision above the level of working foremen (such as general foremen, superintendent, project manager, etc.) is considered to be included in the allowance for Overhead and Profit. Hand tools are defined as equipment with a value of \$1,000 or less. For Contractor owned equipment, the "bare" equipment rental rates allowed to be used for pricing Change Order proposals shall be not more than the monthly rate listed in the most current publication of The AED Green Book divided by 176 to arrive at a maximum hourly rate to be applied to the hours the equipment is used performing the Change Order work
- .6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, material, equipment and Subcontractors. Details to be submitted will include detailed line item estimates showing detailed materials quantity take-offs, material prices by item and related labor hour pricing information and extensions (by line item or by drawing as applicable.) Where major cost items are Subcontracts, they shall also be Itemized as prescribed above. In no case will a change involving over \$10,000 be approved without such an itemization.
- .7 Local Business and Occupation Taxes, if applicable, shall be calculated on the cost of the Work, overhead and profit.
- .8 Overhead and profit shall not be calculated on changes in the Work involving unit prices. Unit prices are to have overhead and profit included in the price quoted.
- .9 Under no circumstances is Contractor permitted to charge for the passage of time (often referred to as general conditions or winter conditions) without an identified, itemlzed, and concretely provable cost borne by Contractor. Contractor has a duty to mitigate costs during a delay period to the fullest extent possible and Contractor will not be paid for costs that could have been mitigated. Calculating a daily delay rate

without properly identifying, itemizing, and proving actual, unmitigateable costs, is prohibited. Contractor understands and accepts that it has the responsibility to prove that costs could not be mitigated prior to submitting a request for payment.

§7.4 Minor Changes in Work. Insert the following sentence at the end of section 7.4:

"Contractor may request that Architect provide written confirmation that Owner has agreed to the minor change, and if requested, Architect will provide it."

# ARTICLE 8 TIME

#### **\$8.3 DELAYS AND EXTENSIONS OF TIME**

§8.3.1 In the first sentence, delete "unusual delay in deliveries," and add "unmitigatable costs attributable to" before the words "adverse weather conditions."

# ARTICLE 9 PAYMENTS AND COMPLETION

#### §9.1 Contract Sum

§9.1.2 Add the following sentence to the end of section 9.1.2:

"Any equitable adjustment of unit prices must be processed as a change order to the contract"

#### §9.2 SCHEDULE OF VALUES

§9.2 Make the following changes to Section 9.2:

In the first sentence add "and the Owner" after the first reference to the Architect. In the second sentence add "or the Owner" after Architect. Remove the last sentence in its entirety and replace it with the following:

"Any changes to the schedule of values shall be submitted to the Architect and the Owner and supported by such data to substantiate its accuracy as the Architect or owner may require. This schedule, unless objected to by the Architect or the Owner, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment."

#### §9.3 APPLICATIONS FOR PAYMENT

§9.3 Make the following changes to Section 9.3:

§9.3.1 In the first sentence add "and the Owner" after the first reference to the Architect and add "and other required documents" after the words "schedule of values."

§9.3.1.1 Delete clause 9.3.1.1 in its entirety and substitute the following:

§9.3.1.1 Such applications may include requests for payment on account of changes in the Work authorized by Construction Change Directives and Change Orders only after a purchase order has been issued for the Work affected.

#### §9.3.1 Add the following clauses to Section 9.3.1:

§9.3.1.3 Until the Work is fifty percent (50%) complete, the Owner will withhold as retainage 10% of the amount due the Contractor on account of progress payments. At the time the Work is fifty percent (50%) complete and thereafter, if the manner of completion of the Work and its progress are and remain satisfactory to the Owner and Architect, and in the absence of other good and sufficient reasons, the Architect will, on presentation by the Contractor of Consent of Surety, authorize any remaining partial payments to be paid in full.

§9.3.1.4 The full Contract retainage may be reinstated if the manner of completion of the Work and its progress do not remain satisfactory to the Owner and Architect, if the Surety withholds its consent, or for other good and sufficient reasons.

#### **§9.4 CERTIFICATES FOR PAYMENT**

§9.4.1 After the phrase "in the full amount of the Application for Payment," insert the phrase "less any retainage withheld pursuant to section 9.3.1.3,".

#### **§9.6 PROGRESS PAYMENTS**

§9.6.7 Delete Section 9.6.7 in its entirety.

§9.6.8 Delete Section 9.6.8 in its entirety.

#### §9.7 FAILURE OF PAYMENT

§9.7 Make the following changes in Section 9.7:

In line two, change "seven days" to "sixty days." In line four, delete "binding dispute resolution" and substitute "the West Virginia Claims Commission"

#### §9.8 SUBSTANTIAL COMPLETION

§9.8.3 Add the following clause to Section 9.8.3:

If Architect is required to perform more than one inspection under this subsection, Contractor shall be responsible for paying the Owner for the cost of the additional inspection, which will be paid by Owner to Architect, at the hourly rate established in the contract between Owner and Architect.

#### §9.8.5 Add the following clause to Section 9.8.5:

§9.8.5.1 The payment of retainage shall be sufficient to increase the total payments to ninety-five percent (95%) for the Work or designated portion thereof being accepted as Substantially Complete, less any amounts as the Architect shall determine for any Work that is not complete, not in accordance with the Contract Documents, or for unsettled claims.

#### **§9.10 FINAL COMPLETION AND FINAL PAYMENT**

§9.10.1 Add the following to the end of Section 9.10.1:

If Architect is required to perform more than one inspection under this subsection, Contractor shall be responsible for paying the Owner for the cost of the additional inspection, which will be paid by Owner to Architect, at the hourly rate established in the contract between Owner and Architect.

§9.10.2 Make the following changes in Section 9.10.2:

In the first sentence, delete "for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner)."

Add the following clause to Section 9.10.2:

§9.10.2.1 Before final payment is due the Contractor, all applicable State and local taxes must be paid. If requested by the Owner, the Contractor shall present evidence that payment or satisfaction of all such tax obligations has been made.

§9.10.3 Add the following clause to Section 9.10.3:

9.10.3.1 Unless and to the extent final completion is delayed through no fault of the Contractor as provided in Section 9.10.3, the Owner shall be under no obligation to increase payments above ninety-five percent (95%) until final completion of the Work is Certified by the Architect.

§9.10.4 Make the following changes in Section 9.10.4:

In the first sentence, delete the word "the" and replace it with "Unless and until the Contractor makes a subsequent Claim against the Owner, the".

Add the following as the last sentence. "Neither the Owner's offer of a final payment nor its acceptance by the Contractor shall legally prevent or limit the Owner's right to assert any and all counterclaims in litigation filed by the Contractor as allowed in section 15.1.8."

Add the following Sections to Article 9:

#### §9.11 LIQUIDATED DAMAGES

§9.11.1 The Owner will suffer financial loss if the Work is not Substantially Complete within the Contract Time as defined in Article 8, and if final completion is not achieved within the specified time frame following Substantial Completion. As liquidated damages, and not as a penalty, the Contractor and the Contractor's surety shall be liable for and shall pay the Owner the sum(s) stated in this Agreement and/or purchase order.

§9.11.2 Allowances may be made for delays due to shortages of materials and/or energy resources, subject to proof by documentation, and also for delays due to strikes or other delays beyond the control of the Contractor. All delays and any claim for extension of Contract Time must be properly documented in accordance with Section 15.1.5 by the Contractor and must be made within the time limits stated in Section 15.1.2.

# ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

#### §10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

§10.2.8 Make the following changes to Section 10.2.8:

In the first sentence, delete "within a reasonable time not exceeding 21 days" and substitute "immediately".

#### §10.3 HAZARDOUS MATERIALS

§10.3.3 Delete Section 10.3.3 in its entirety.

# ARTICLE 11 INSURANCE AND BONDS

#### §11.1 CONTRACTOR'S LIABILITY INSURANCE

§11.1.2 Add the following to the end of §11.1.2.

At a minimum the Contract shall provide, at the Contractor's Expense:

§11.1.2.1. a Performance Bond and a Labor and Material Payment Bond for 100% of the Contract Sum and, if applicable, a two-year roofing Maintenance Bond for the full value of the roofing system.

§11.1.2.2 An attorney-in-fact who executes the bonds on behalf of the surety shall affix thereto a certified and current copy of power of attorney.

§11.1.2.3 The bonds shall be issued on State of West Virginia forms. The Contractor shall deliver the required bonds and all other contract documents to the Owner not later than 15 days following receipt of the Owner's notice of intent to award a Contract.

§11.2 Owner's Insurance Delete section 11.2 in its entirety.

§11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

§11.4 Section 11.4 is deleted in its entirety.

§11.5.1 Make the following changes in Section 11.5.1:

In the first sentence, substitute "Contractor" for "Owner" each time the latter word appears.

§11.5.2 Delete Section 11.5.2 in its entirety and substitute the following:

§11.5.2 Prior to settlement of insured loss, the Contractor shall notify the parties of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The parties shall have 14 days from the receipt of notice to object. If no objection is made, the Contractor shall proceed as proposed and allocate the settlement accordingly. If such objection is made, the dispute shall be resolved as provided in Section 15.4. The Contractor, in that case, shall make settlement with insurers in accordance with directions of the Court. If distribution of the insurance proceeds as directed by the Court is required, the Court will direct such distribution. Any work to repair the damage will be incorporated into the contract as a change order.

# ARTICLE 13 MISCELLANEOUS PROVISIONS

#### §13.4 TESTS AND INSPECTIONS

§13.4.1 Remove the phrase "so require" and insert in its place "prohibit delegation of the test to Contractor"

#### §13.6 INTEREST

§13.6 Delete Section 13.5 in its entirety and substitute the following:

Notwithstanding any other provision in the Contract Documents, West Virginia Code does not authorize the payment of interest on late payments. Accordingly, interest charges for late payment are prohibited.

Add the following Sections to Article 13:

#### §13.6 WORKERS COMPENSATION

The Contractor shall provide proof of compliance with West Virginia Worker's Compensation laws and regulations.

#### §13.7 CONTRACTOR'S LICENSE

§13.7.1 West Virginia Code §21-11-2 requires that all persons desiring to perform contractual work in West Virginia shall be duly licensed. The West Virginia Contractor's Licensing Board is empowered to issue a contractor's license.

§13.7.2 West Virginia Code §21-11-11 requires any prospective Bidder to include the Bidder's contractor's license number on its Bid. The successful Bidder will be required to furnish a copy of its contractor's license in a classification appropriate to the Work prior to issuance of a purchase order/contract.

# ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### §14.1 TERMINATION BY THE CONTRACTOR

§14.1.1 Make the following changes in Section 14.1.1:

At the end of clause 14.1.1.3 delete "; or" and insert a period.

Delete clause 14.1.1.4 in its entirety.

§14.1.3 Delete Section 14.1.3 in its entirety and substitute the following:

§14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exist, the Contractor may, upon seven days written notice to the Owner and Architect, terminate the Contract. In such event, the Contractor shall be paid for all Work performed in accordance with the Contract Documents, for reasonable and proven termination expenses and a reasonable allowance for overhead and profit. However, such payment, exclusive of termination expenses, shall not exceed the Contract Sum as reduced by other payments made to the Contractor and further reduced by the value of Work as yet not completed. The Contractor shall be entitled to reasonable overhead, but not profit, on Work not performed.

#### §14.2 TERMINATION BY THE OWNER FOR CAUSE

§14.2.4 Delete Section 14.2.4 in its entirety and substitute the following:

§14.2.4 If the unpaid balance of the Contract Sum exceeds the cost 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 not 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 Owner shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

#### §14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

- §14.4.1 Delete Section 14.4.1 in its entirety and substitute the following:
  - §14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause upon thirty days written notice.
- §14.4.3 Delete Section 14.4.3 in its entirety and substitute the following:
  - §14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Section 14.1.3 above.

Add the following Section to Article 14:

#### §14.5 FISCAL YEAR FUNDING

§14.5 Work performed under this Contract is to continue in the succeeding fiscal year contingent upon funds being appropriated by the Legislature for this Work. In the event funds are not appropriated for this Work, this Contract becomes of no effect and is null and void after June 30.

# ARTICLE 15 CLAIMS AND DISPUTES

#### §15.1 Claims

#### §15.1.2 TIME LIMITS ON CLAIMS

§15.1.2 Delete Section 15.1.2 in its entirety and substitute the following:

Any applicable statute of limitations shall be in accordance with West Virginia Code.

- §15.1.3 NOTICE OF CLAIMS Add the following to § 15.1.3;
  - §15.1.3.3 All claims, and notice of claims that require an increase in contract time, contract scope, or contract sum must be made in writing.
- § 15.1.8 is added to the Contract as follows:

§ 15.1.8 Counterclaims – In the event that Contractor makes a claim, Owner reserves the right to make a counterclaim and will not be barred from doing so even if final payment has been made.

#### §15.2 INITIAL DECISION

- §15.2.1 In the third sentence of Section 15.2.1, insert "or litigation" following the word "mediation" and remove the phrase "binding dispute resolution" and replace it with "or litigation".
- §15.2.5 Delete the last sentence in Section 15.2.5 and substitute the following:

Approval or rejection of a claim by the Initial Decision Maker shall be final and binding on the parties unless it is pursued further by either party in accordance with Section 15.2.6.

§15.2.6 Make the following change to clause 15.2.6.1:

In the last sentence, delete "or pursue binding dispute resolution proceedings."

§15.2.8 Delete Section 15.2.8 in its entirety.

#### §15.3 MEDIATION

- §15.3.1 Delete "binding dispute resolution" and substitute "litigation in a court of competent jurisdiction."
- §15.3.2 Delete Section 15.3.2 in its entirety and substitute the following:
  - §15.3.2 The parties shall endeavor to resolve their Claims by non-binding 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.
- § 15.3.3 Remove section 15.3.3 in its entirety

#### §15.4 ARBITRATION

§15.4 Delete Section 15.4 in its entirety and substitute the following:

#### §15.4 SETTLEMENT OF CLAIMS

§15.4.1 The Constitution of West Virginia grants the State sovereign immunity from any and all Claims against the public treasury. This immunity applies and is extended to all agencies of the State, including the Owner. It shall be in full force and effect as it relates to this Contract. The West Virginia Legislature, recognizing that certain Claims against the State may constitute a moral obligation of the State and should be heard, has established the West Virginia Claims Commission for this purpose. The Parties understand that this sovereign immunity and the Constitution of the

State of West Virginia prohibit the State and Owner, from entering into binding arbitration. Notwithstanding any provision to the contrary in the Contract Documents, all references to arbitration, regardless of whether they are included in the AIA Document A201-2017 or another related document are hereby deleted and all Claims of the Contractor for monetary relief, and only of the Contractor, arising out of or related to this Contract shall be decided by the West Virginia Claims Commission. The following Sections have been rewritten to bring them into conformance with the foregoing.

§15.4.2 Claims by the Owner may be brought against the Contractor in the Circuit Court of Kanawha County, West Virginia, or in any other court that has jurisdiction, as the Owner may elect.

§15.4.3 Any Claim arising out of or related to the Contract, except Claims relating to aesthetic effect and except those waived as provided for in Sections 15.1.6, 9.10.4 and 9.10.5, shall, within 30 days after submission of the decision by the Initial Decision Maker, be settled for the Contractor by the West Virginia Claims Commission or, for the Owner, by the Circuit Court of Kanawha County or any other court of jurisdiction as the Owner may elect.

§15.4.4 Notice of such action shall be filed in writing with the other party to the Contract, and a copy of such notice shall be filed with the Initial Decision Maker and the Architect, if applicable.

§15.4.5 During court proceedings, the Owner and the Contractor shall comply with Section 15.1.3.

§15.4.6 Claims shall be made within the time limits specified in Section 15.2.6.1.

§15.4.7 The party filing a Claim must assert in the demand all Claims then known to that party on which action is permitted.

Add the following Article:

# ARTICLE 16 EQUAL OPPORTUNITY

§16.1 COMPLIANCE WITH REGULATIONS UNDER TITLE VI OF THE FEDERAL CIVIL RIGHTS ACT OF 1964 AND EXECUTIVE ORDER 65-2 BY THE GOVERNOR OF WEST VIRGINIA DATED DECEMBER 15, 1965

§16.1.1 The Contractor agrees that it will comply with Title VI of the Federal Civil Rights Act of 1964 (P.L. 88352) and the regulations of the State of West Virginia, to the end that no person in the State, or in the United States, shall on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or otherwise subjected to discrimination under any program or activity for which the Contractor receives any recompense or other consideration of value, either directly or indirectly from the State; and HEREBY GIVES ASSURANCE THAT it will immediately take any measures necessary to effectuate this Agreement.

§16.1.2 If any real property or structure thereon is provided or improved, this assurance shall obligate the Contractor, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which any State payment is extended or for another purpose involving the provision of similar services or benefits. If any other goods or services are so provided, this assurance shall obligate the Contractor for the period during which it supplies such goods or services.

§16.1.3 The Contractor recognizes and agrees that such right to provide property, goods or services to the State will be extended in reliance on the representations and agreements made in assurance, and that the State shall have the right to seek judicial enforcement of this assurance. This is binding on the Contractor, its successors, transferee, and assignee, or any authorized person on behalf of the Contractor.

END OF SUPPLEMENTARY CONDITIONS TO AIA DOCUMENT A201-2017

State of West Virginia

Any provisions of the Contract Documents that conflict with these Supplementary Conditions shall be null and void unless they have been approved in writing by the applicable State purchasing officer and the Attorney General, and are clearly identified as such in the bid documents.

The Owner and Contractor hereby agree to the full performance of the covenants contained herein.

IN WITNESS WHEREOF, the Owner and Contractor have entered into this Agreement as of the effective date as stated in the A101-2017 (when utilized) or other Contract Documents.

Owner:	Contractor:
Ву:	Ву:
Title:	Title:
Date:	Date:

This Supplementary Conditions to AIA Document A201-2017, General Conditions of the Contract for Construction, has been approved as to form on this 20th day of 12019, by the West Virginia Attorney General's office as indicated in the signature line below. Any modification of this document is void unless expressly approved in writing by the West Virginia Attorney General's Office.

PATRICK MORRISEY, ATTORNEY GENERAL

DEPUTY ATTORNEY GENERAL

Effective Date: October 1, 2018 Page 12

### Change Order

PROJECT: (Name and address)
WV State Capitol Complex
Building 3 Hydronic Boiler
System Upgrades

OWNER: (Name and address)
WV General Services Division
112 California Avenue, 5th Floor
Charleston, WV 25305

CONTRACT INFORMATION: Contract For:

Date:

CHANGE ORDER INFORMATION:

Change Order Number:

Date:

ARCHITECT: (Name and address)
ZDS Design/Consulting Services
135 Corporate Center Drive, Suite 532

Scott Depot, WV 25560

**CONTRACTOR**: (Name and address)

0.00

0.00

#### THE CONTRACT IS CHANGED AS FOLLOWS:

(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

The original Contract Sum was

The net change by previously authorized Change Orders

The Contract Sum prior to this Change Order was

The Contract Sum will be increased by this Change Order in the amount of

The new Contract Sum including this Change Order will be

The Contract Time will be increased by Zero (0) days. The new date of Substantial Completion will be

**NOTE**: This Change Order does not include adjustments to the Contract Sum or Guaranteed Maximum Price, or the Contract Time, that have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

#### NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.

ZDS Design/Consulting Services		WV General Services Division
ARCHITECT (Firm name)	CONTRACTOR (Firm name)	OWNER (Firm name)
SIGNATURE	SIGNATURE	SIGNATURE
PRINTED NAME AND TITLE	PRINTED NAME AND TITLE	PRINTED NAME AND TITLE
DATE	DATE	DATE

### Application and Certificate for Payment

TO OWNER:	WV General Services Division 112 California Avenue, 5th Floor	PROJECT:		Complex nic Boiler System	APPLICATION NO: 001 PERIOD TO:	<u>Distribution to:</u> OWNER: ☐
	Charleston, WV 25305		Upgrades			ARCHITECT: □
						CONTRACTOR:
FROM		VIA			CONTRACT FOR: General Co CONTRACT DATE:	onstruction FIELD:
CONTRACTOR	<b>?</b> :	ARCHITECT:	ZDS Design/Consultations 135 Corporate Cent Scott Depot, WV 25	er Drive, Suite 532	PROJECT NOS: /	/ OTHER: □
				•)		
CONTRAC	TOR'S APPLICATION FOR F	PAYMENT				the best of the Contractor's knowledge,
	nade for payment, as shown below, in com G703®, Continuation Sheet, is attached.	nection with the Co	ntract.	completed in acco	ordance with the Contract Doc	this Application for Payment has been cuments, that all amounts have been paid Certificates for Payment were issued and
1. ORIGINAL CO	NTRACT SUM		\$0.00			rent payment shown herein is now due.
2. NET CHANGE	BY CHANGE ORDERS		\$0.00	CONTRACTOR:		
	UM TO DATE (Line 1 ± 2)					Date:
4. TOTAL COMP	PLETED & STORED TO DATE (Column G or	G703)	\$0.00	State of:		
5. RETAINAGE:				County of:		
	of Completed Work			Subscribed and swo		
	D + E on G703)	-	\$0.00	me this d	lay of	
	6 of Stored Material F on G703)		\$0.00	Notary Public:		
	age (Lines 5a + 5b or Total in Column I of		\$0.00		pires:	
						AVMENT
	ED LESS RETAINAGE		\$0.00		S CERTIFICATE FOR P	
	ess Line 5 Total)		\$0.00	In accordance wi	polication the Architect certi-	ased on on-site observations and the data fies to the Owner that to the best of the
	OUS CERTIFICATES FOR PAYMENT		\$0.00	Architect's knowl	edge, information and belief t	he Work has progressed as indicated, the
(Line 6 II	om prior Certificate)			quality of the Wo	rk is in accordance with the C	contract Documents, and the Contractor is
8. CURRENT PA	YMENT DUE		\$0.00	entitled to payme	nt of the AMOUNT CERTIFIE	ED.
9. BALANCE TO	FINISH, INCLUDING RETAINAGE	_		AMOUNT CERTIFIED	)	\$0.00
(Line 3 le	ess Line 6)		\$0.00	(Attach explanation	if amount certified differs from the	ne amount applied. Initial all figures on this hanged to conform with the amount certified.)
<del></del>				The far are		

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$0.00	\$0.00
Total approved this Month	\$0.00	\$0.00
TOTALS	\$0.00	\$0.00
NET CHANGES by Change Order		\$0.00

User Notes:

ARCHITECT:		
By:	Date:	

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.



### Continuation Sheet

AIA Document G702®, Application and Certification for Payment, or G732™, APPLICATION NO: 001 Application and Certificate for Payment, Construction Manager as Adviser Edition, APPLICATION DATE: containing Contractor's signed certification is attached. PERIOD TO: Use Column I on Contracts where variable retainage for line items may apply. ARCHITECT'S PROJECT NO: GSD221C

A	В	С	D	Е	F	G		Н	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK CO FROM PREVIOUS APPLICATION (D+E)	THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D + E + F)	% (G÷C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
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		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00%	0.00	0.00
	GRAND TOTAL	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	0.00%	\$0.00	\$0.00

### Certificate of Substantial Completion

PROJECT: (name and address	s)
WV State Capitol Complex	
Building 3 Hydronic Boiler	

System Upgrades

OWNER: (name and address) WV General Services Division 112 California Avenue, 5th Floor Charleston, WV 25305

CONTRACT INFORMATION:

Contract For: Date:

CERTIFICATE INFORMATION:

Certificate Number:

Date:

ARCHITECT: (name and address) ZDS Design/Consulting Services 135 Corporate Center Drive, Suite 532

Scott Depot, WV 25560

CONTRACTOR: (name and address)

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate. (Identify the Work, or portion thereof, that is substantially complete.)

ZDS Design/Consulting Services			
ARCHITECT (Firm Name)	SIGNATURE	PRINTED NAME AND TITLE	DATE OF SUBSTANTIAL COMPLETION

#### WARRANTIES

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

#### WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows: (Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within ) days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR (Firm	SIGNATURE	PRINTED NAME AND TITLE	DATE
Name)			
WV General Services			
Division			×
OWNER (Firm Name)	SIGNATURE	PRINTED NAME AND TITLE	DATE

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### Contractor's Affidavit of Payment of Debts and Claims

PROJ	ECT: (Name and address)	ARCHITECT'S PROJEC	T NUMBER:	OWNER:
	State Capitol Complex	GSD-221-C		ARCHITECT:
	ing 3 Hydronic Boiler	CONTRACT FOR:		CONTRACTOR:
	m Upgrades			SURETY:
	NNER: (Name and address)	CONTRACT DATED:		OTHER:
	Design/Consulting Services			
	Corporate Center Drive			
Suite	532			
Scott	Depot, WV 25560			_
STATI	E OF:			
	ITY OF:			
The u	ndersigned hereby certifies the	at except as listed below	navment has been made in ful	l and all obligations have otherwise
			all work, labor, and services per	
				ction with the performance of the
				eld responsible or encumbered.
		•		
EXCE	PTIONS:			
SUPP	ORTING DOCUMENTS AT	TACHED HERETO:	CONTRACTOR: (Name and	d address)
1.	Consent of Surety to Final		comment (manne and	audi cooj
	Surety is involved, Consen			
	required. AIA Document			
	Surety, may be used for thi			
Indica	ate Attachment	Yes No		
			BY:	
The fo	ollowing supporting document.	s should be attached	(Signature of autho	rized representative)
	o if required by the Owner:		( 0	,
1.	Contractor's Release or Wa	aiver of Liens	(Printed name and	title)
	conditional upon receipt of		(1 rinted hame and	
•	o . n.i w. :	CT . C	01 11 1 1 1	C 41' 1
2.	Separate Releases or Waiv		Subscribed and sworn to be	efore me on this date:
	Subcontractors and materia			
	suppliers, to the extent requaccompanied by a list there			
	accompanied by a list there	.01.	Notary Public:	
3.	Contractor's Affidavit of R	elease of Liens (AIA	My Commission Expires:	
	Dogument G706A)	cicuse of Liens (iliii	my commission Expires.	

### Contractor's Affidavit of Release of Liens

PROJ	ECT: (Name and address)	ARCHITECT'S PRO	JECT NUMBER	: OWNER:
	State Capitol Complex	GSD-221-C		ARCHITECT: □
	ing 3 Hydronic Boiler m Upgrades	CONTRACT FOR:		CONTRACTOR: □
TO O	WNER: (Name and address)	CONTRACT DATE	):	SURETY:
	Design/Consulting Services Corporate Center Drive, Suite 532	2		OTHER:
Scott	Depot, WV 25560			
STAT	E OF:			
	ITY OF:			
assert refere EXCE	tliens or encumbrances against a enced above.  PTIONS:  PORTING DOCUMENTS ATTA	any property of the Own	ner arising in ar	may have liens or encumbrances or the right to my manner out of the performance of the Contract  TOR: (Name and address)
1.	Contractor's Release or Waiv conditional upon receipt of fi			
2.	Separate Releases or Waiver	s of Liens from	BY:	
	Subcontractors and material suppliers, to the extent require accompanied by a list thereof	ed by the Owner,		(Signature of authorized representative)
				(Printed name and title)
			Subscribed	I and sworn to before me on this date:
			Notary Pul	blic:



### Consent Of Surety to Final Payment

PROJECT: (Name and address)	ARCHITECT'S PROJECT NUMBER: GSD221C	OWNER:
WV State Capitol Complex Building 3 Hydronic Boiler	CONTRACT FOR:	ARCHITECT:
System Upgrades		CONTRACTOR:
TO OWNER: (Name and address)	CONTRACT DATED:	SURETY:
ZDS Design/Consulting Services	CONTINUE BALLS.	OTHER:
135 Corporate Center Drive, Suite 532 Scott Depot, WV 25560		
ANN AN ANY A		1
In accordance with the provisions of the Control (Insert name and address of Surety)	ract between the Owner and the Contractor as indicated above, the	
		CUDETV
on bond of		, SURETY,
(Insert name and address of Contractor)		
		, CONTRACTOR,
hereby approves of the final payment to the C not relieve the Surety of any of its obligations (Insert name and address of Owner)	ontractor, and agrees that final payment to the Contractor shall to	
		, OWNER,
as set forth in said Surety's bond.		
IN WITNESS WHEREOF, the Surety has her (Insert in writing the month followed by the na		
	(Surety)	
	(Signature of authorized representa	tive)
Attest:		
(Seal):	(Printed name and title)	



### Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: (Name and address)	ARCHITECT'S PROJECT NUMBER	: GSD221C	OWNER:
WV State Capitol Complex	CONTRACT FOR:		ARCHITECT:
Building 3 Hydronic Boiler System Upgrades	CONTRACT FOR.		CONTRACTOR:
			SURETY:
TO OWNER: (Name and address)	CONTRACT DATED:		
ZDS Design/Consulting Services			OTHER:
135 Corporate Center Drive			
Suite 532			
Scott Depot, WV 25560			
In accordance with the provisions o	of the Contract between the Owner an	d the Contractor as indicated	
above, the			
(Insert name and address of Surety,	)		
			CLIDETA
on bond of			, SURETY,
(Insert name and address of Contra	actor)		
			, CONTRACTOR,
hereby approves the reduction in or	partial release of retainage to the Co	ntractor as follows:	
The Surety agrees that such reduction	on in or partial release of retainage to	the Contractor shall not relieve	
the Surety of any of its obligations		the Contractor shall not reneve	
(Insert name and address of Owner,			
			, OWNER,
as set forth in said Surety's bond.			
	ety has hereunto set its hand on this d	late:	
(Insert in writing the month followe	d by the numeric date and year.)		
		(Surety)	
		(Signature of authorized represen	tative)
		, o	7
Attest:		(D 1	
(Seal):		(Printed name and title)	



### **Proposal Request**

PROJECT: (name and address)
WV State Capitol Complex
Building 3 Hydronic Boiler
System Upgrades

OWNER: (name and address)
WV General Services Division
112 California Avenue, 5th Floor
Charleston, WV 25305

CONTRACT INFORMATION:

Scott Depot, WV 25560

Contract For: Date:

Architect's Project Number: Proposal Request Number: Proposal Request Date:

ARCHITECT: (name and address)

ZDS Design/Consulting Services
135 Corporate Center Drive, Suite 532

The Owner requests an itemized proposal for changes to the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. The Contractor shall submit this proposal within Zero (0) days or notify the Architect in writing of the anticipated date of submission.

(Insert a detailed description of the proposed modifications to the Contract Documents and, if applicable, attach or reference specific exhibits.)

THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE, OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.

REQUESTED BY THE ARCHITECT:

PRINTED NAME AND TITLE



### Architect's Supplemental Instructions

PROJECT: (name and address)
WV State Capitol Complex
Building 3 Hydronic Boiler System
Upgrades

OWNER: (name and address)
WV General Services Division
112 California Avenue, 5th Floor

Charleston, WV 25305

CONTRACT INFORMATION:

Contract For: Date: ASI INFORMATION: ASI Number: 001

Date:

ARCHITECT: (name and address)
ZDS Design/Consulting Services
135 Corporate Center Drive, Suite 532

Scott Depot, WV 25560

CONTRACTOR: (name and address)

The Contractor shall carry out the Work in accordance with the following supplemental instructions without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:	
ZDS Design/Consulting Services	
ARCHITECT (Firm name)	
SIGNATURE	
PRINTED NAME AND TITLE	
DATE	

### **Construction Change Directive**

PROJECT: (name and address) WV State Capitol Complex Building 3 Hydronic Boiler System Upgrades	CONTRACT INFORMATION: Contract For: Date:	CCD INFORMATION: Directive Number: Date:
OWNER: (name and address) WV General Services Division 112 California Avenue, 5th Floor Charleston, WV 25305	ARCHITECT: (name and address) ZDS Design/Consulting Services 135 Corporate Center Drive, Suite 532 Scott Depot, WV 25560	CONTRACTOR: (name and address)
	o make the following change(s) in this Co e change and, if applicable, attach or refer	
PROPOSED ADJUSTMENTS  1. The proposed basis of adjustment of the proposed basis of the p	ustment to the Contract Sum or Guarantee of \$0.00	d Maximum Price is:
☐ Unit Price of \$	per	
	ow, plus the following fee:  of, or method for determining, cost)	
2. The Contract Time is prop	oosed to . The proposed adjustment,	if any, is
	Contractor should execute a Change Orde pon adjustments to the Contract Sum, Con	r to supersede this Construction Change ntract Time, or Guaranteed Maximum price for
	ect and received by the Contractor, this docume a Construction Change Directive (CCD), and ge(s) described above.	
ZDS Design/Consulting Services	WV General Services Division	
ARCHITECT (Firm name)	OWNER (Firm name)	CONTRACTOR (Firm name)
SIGNATURE	SIGNATURE	SIGNATURE
PRINTED NAME AND TITLE	PRINTED NAME AND TITLE	PRINTED NAME AND TITLE
DATE	DATE	DATE

### Request for Information ("RFI") FROM: PROJECT: ISSUE DATE: RFI No. WV State Capitol Complex Building 3 Hydronic Boiler System Upgrades REQUESTED REPLY DATE: PROJECT NUMBERS: GSD221C / COPIES TO: RFI DESCRIPTION: (Fully describe the question or type of information requested.) REFERENCES/ATTACHMENTS: (List specific documents researched when seeking the information requested.) SPECIFICATIONS: DRAWINGS: OTHER: SENDER'S RECOMMENDATION: (If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.) RECEIVER'S REPLY: (Provide answer to RFI, including cost and/or schedule considerations.) BY DATE **COPIES TO**

**Note:** This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.

# DIVISION 1 GENERAL

#### SECTION 011000 - SUMMARY

#### PART 1 - GENERAL

#### 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

#### 1.2 SUMMARY

#### A. Section includes:

- 1. Project information.
- 2. Work covered by Contract Documents.
- Access to Site.
- 4. Coordination with Owner/occupants.
- 5. Work restrictions.
- 6. Specification and Drawing Conventions.
- 7. Permits and Fees
- 8. Miscellaneous Provisions

#### B. Related Section:

- 1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
- 2. The Contractor shall review every specification to fully ascertain the scope of the Work contained therein. Any modifications made necessary due to such document coordination shall be brought to the attention of the Engineer immediately for resolution. Extensions of Contract time or price shall not be granted when such document coordination did not take place.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Building #3 Hydronic Boiler System Upgrades:
  - 1. Project Location:
    - a. Building #3, WV Capitol Complex, 1900 Kanawha Boulevard East, Charleston WV
- B. Owner:

- 1. West Virginia Department of Administration, General Services Division, 1900 Kanawha Boulevard East, Charleston, WV 25305
- C. Engineer: The Contract Documents, dated January 9, 2023, were prepared for the Project by ZDS Design/Consulting Services, 135 Corporate Center Drive, Suite 532, Scott Depot, WV 25560.

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of the Project is defined by the Contract Documents and consists of, but is not limited to, the following:
  - 1. Project goal is for Building #3 to be converted from the existing steam heating system to a new Hot Water heating system. Construction is anticipated to occur during seasonal shutdown of the heating systems (generally mid-May until October but subject to weather conditions) beginning in summer seasonal shutdown of 2023 and completing remaining Work prior to October of 2024. Work not impacting existing heating systems may begin right away. The Contractor shall ensure that the heating system can be operated during the heating season winter of 2023-2024 and must complete work sufficiently to safely operate the system. A schedule must be provided by the Contractor showing how this will be accomplished prior to commencement of construction. The transition points may vary from what's shown on plans with approval by the Engineer/Owner. Connection of new piping to existing piping during the phased Work will be required and must be performed properly. Refer to Bidding documents issued by the State of West Virginia for schedules and timeframes to be complied with on the Project. If discrepancies are identified, the State documents supersede language in this section.
  - 2. Demolition of selected existing steam systems in the basement of Building #3 including a steam pressure reducing station, piping, valves and steam condensate pumping stations. Pumping stations, steam-to-hot water convertor, spare convertor tube assembly and other items the Owner request to be salvaged shall be carefully disconnected and removed for potential storage by Owner for future use
  - 3. Provide new Heating HW Boilers, pumps, specialties, piping, valves, and insulation.
  - 4. Construction of a new addition to the existing utility building to house the new HHW boiler systems.
  - 5. Provide new natural gas service from existing underground natural gas distribution line located Northeast corner of the site to the new addition on the existing Pavilion building located on the Northwest corner adjacent to Building #3 site to serve the new Boilers. The work also includes a new natural gas meter set enclosed within custom fencing constructed as part of this project.
  - 6. Modify the existing building DDC controls to incorporate the new HHW Boiler systems.
  - 7. Modify and extend the existing dry sprinkler system to provide fire protection for the new addition.
  - 8. Provide electrical work necessary for the new installations and the new addition including, but not limited to, equipment power, lighting, general use receptacles, and Fire Alarm modifications.

- 9. Contractor shall provide construction barriers/fencing as required for the safety of employees and public. ADA Access to the building shall be maintained via the East ramp opposite where construction is occurring. All procedures shall be coordinated with the Owner's representatives following State job safety protocols and will be in compliance with the office of the West Virginia State Fire Marshal.
- 10. The submittals for equipment critical for achieving the schedule shall be submitted within 30 days of award.
- 11. The existing underground steam and pumped condensate piping if any, that is abandoned is to be abandoned in place except where noted to be removed.
- 12. Excavation, trenching and backfill necessary to complete the Work.
- 13. Perform work in the existing MH#3 vault that includes, but is not limited to, removal and replacement of selected piping, removal and replacement of insulation required for removal of steam branch piping currently serving Building #3. The work also includes cleanup all materials/debris that has accumulated in the vault. Provide confined space entry for work as required by the construction documents into the existing vault identified as MH#3 including proof of compliance with confined space entry requirements. Contractor shall be responsible for providing all equipment and personnel to comply with OSHA requirements. requirements. Refer to drawings for additional information.
- 14. Provide waterproofing to encapsulate the exterior of building #3 penetrations as detailed on the construction documents.
- 15. Provide new insulation as indicated on the drawings and as required to cover all piping, ductwork, fittings, and valves impacted by this Project. Contractor shall furnish and install insulation on all new piping, fittings, valves, and equipment unless otherwise recommended by the equipment manufacturer that are recommended to stay uninsulated by manufacturer. Contractor shall include additional insulation in the base bid proposal, beyond what is indicated and noted in the bid documents, as follows:
  - a. Provide a minimum of five (5) lineal feet on existing piping and fittings, of all sizes, at points of new pipe connections.
  - b. Where new valves, and fittings are shown installed in existing piping systems, provide a minimum of five (5) lineal feet (If) of insulation on either side of the components for the existing pipe and fittings.
  - c. Allow for an additional 100 lineal feet of insulation for existing pipe and fittings in sizes up to 8" to be applied where missing/damaged insulation is encountered and as directed by the Owner/Engineer.
  - d. All costs for complete furnishing and installing the additional insulation described here shall be included in the contractor's base bid proposal.
- 16. Contractor shall field verify and identify existing underground utilities discovered during installation of new work since all underground utilities are not fully known. Site plans of Campus will be provided to the successful Contractor to use for identifying as-built conditions discovered during this portion of the Work where it may differ from that shown on the construction drawings. The Contractor shall identify the underground utility's locations and routing on drawings to be furnished to the Engineer and provide high resolution electronic color photos clearly identifying each location, depth, size, and purpose including the direction of flow that are applicable and are different than the record drawing information provided to the Contractor. The intent is to continue updating the Campus site record drawings as more field information is available. Identify type of service (steam, condensate, Sanitary, storm, domestic cold water, electric, etc.), pipe/utility size, and approximate elevation below grade at discovered points on the site. As-built

- drawings are in progress, so the intent is for the Contractor to provide updates to the record drawings of existing utility systems where routing, sizes, etc. may differ from the construction drawings and currently available record drawings. All work shall be included in the Base Bid proposal and shall be performed by Contractor at no additional cost to the Owner.
- 17. Lead is assumed to be present within Building #3 due to age. Contractor shall comply with OSHA 29 CFR 1926.62 for construction activities and include all costs in Bid to meet the Project requirements.
- 18. Demolition work shall include, but not be limited to, removal of existing piping, valves, fittings, and insulation as indicated in the construction documents and as required for installation of new work.
- 19. The work on site will include removal and replacement of concrete, brick, granite, and other hardscape materials. All replacement of materials, when underground work is completed, will match the existing materials, dimensions, and configurations. Grassy areas that are disturbed during the Work will be regraded and reseeded to the satisfaction of the Owner's representative.
- 20. Contractor shall provide a two (2) year complete parts and labor warranty for all Work included in the Project. Warranty shall begin when Substantial Completion is achieved.
- 21. Project will be constructed under a single prime contract.

## 1.5 ACCESS TO SITE

- A. Use of Site: Limit use of existing building to work in areas permitted. Do not disturb portions of building beyond areas in which the Work is indicated.
- B. Keep existing walkways, driveways and entrances serving the premises clear and available throughout the construction schedule and available to Owner, Owner's employees, and visitors. Do not use any areas for parking or storage of materials except as approved by Owner. Schedule deliveries to minimize use of driveways and entrances by construction operations. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Do not encumber the site with materials or equipment. Confine stockpiling of materials and location of storage areas as acceptable to Owner.
- D. Keep all vehicles locked and other mechanized construction equipment when parked and unattended. Do not leave any vehicle or equipment unattended with motor running or ignition key in place.
- E. Condition of Existing Building: Repair damage caused by construction operations.
- F. Condition of Existing Grounds: Repair damage caused by construction operations.

## 1.6 COORDINATION WITH OWNER/OCCUPANTS

A. Full Owner Occupancy: Coordinate and cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations.

- 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
- 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

## 1.7 WORK RESTRICTIONS

- A. Owner reserves the right to occupy and use spaces where work is completed and/or substantially completed prior to Substantial Completion of the work. Such occupancy shall not constitute acceptance of the completed Work. Before limited Owner occupancy, systems shall be fully operational and required tests and inspections shall be successfully completed.
- B. General: Contractor shall limit his use of the premises to the Work indicated. Coordinate with Owner any access required to perform the Work in areas not normally accessible. Contractor shall schedule the Work to not disturb the operation of the facility when occupied. All required life safety requirements must be maintained when the building is in use. Contractor shall include off hour construction time into their bids as required to meet the construction schedule and minimize disruption of the facility when occupied. Only if pre-approved by the Owner in writing shall the work occur during normal work hours.
- C. On-Site Work Hours: Limit work in the building when unoccupied, except as otherwise indicated.
- D. Weekend Hours: Coordinate with the Owner in advance at no additional costs to the Owner.
  - 1. Early Morning Hours: As coordinated with and approved by the Owner and Engineer and at no additional cost to the Owner.
  - 2. Hours for Utility Shutdowns: Coordinate with the Owner.
  - 3. Hours for excessive noise activities: Before or after occupied hours.
  - 4. Hours for chemical treatments or activities that generate odors: Before or after occupied hours.
  - 5. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services per requirements indicated:
  - 6. Notify Owner's representative not less than two days in advance of proposed utility interruptions. Obtain Owner's representatives written permission before proceeding with utility interruptions/shut offs.
- E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner, and authorities having jurisdiction for restrictions on noisy work.
  - 1. Notify Owner's representative not less than two days in advance of proposed disruptive operations.

- 2. Obtain Owner's representatives written permission before proceeding with disruptive operations.
- 3. Clean spaces where high levels of dust have been created including furniture, fixtures, floors, and equipment.
- F. ALL material and equipment that shall become part of the finished Project shall not be stored in direct contact with the ground. Said material and equipment shall be protected by means of weatherproof cover during exterior staging and protective interior covering of adequate strength and durability to prevent marring or damage to finished surfaces during interior staging.
- G. Controlled Substances: Controlled substances anywhere on the Project site/property is not permitted. Contractor, subcontractors, and suppliers shall ensure that their employees, while working on the Owner's property, shall not purchase, transfer, use or possess illegal drugs, alcohol, or abuse prescription drugs in any way.
- H. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags throughout the construction period.

## 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. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations and scheduled on drawings.
  - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

## 1.9 PERMITS AND FEES

- A. Contractor shall be responsible for providing and coordinating specified and/or required permits, approvals, inspections, warranties, guarantees, and certifications including those required for Work or items supplied by its subcontractors. Contractor shall be responsible for fees required for temporary services related to their work. The Owner will pay for water, gas, sewer, and electric usage for actual construction activities within the building(s).
- B. Special permits, fees, taxes and/or licenses not identified but necessary for the lawful execution of the Work shall be obtained and paid for by the Contractor executing the Work.

## 1.10 MISCELLANEOUS PROVISIONS

## A. Personal Conduct

- 1. The use of loud, obtrusive, or offensive language is strictly prohibited always on, and around, the project site. The use of radios or other music playing devices is prohibited.
- 2. Proper dress on-site for all contractor and subcontractor personnel will be required; wearing of short pants will not be permitted; only full length "pants" are to be worn and shirts must be worn by all workers. Proper personal protective equipment including footwear and hard hats must be worn where/when necessary. Failure to comply with the above will result in dismissal from the project site at the Owner's representative or Engineer's discretion.
- 3. There will be no break rooms within the building.
- 4. Contractors will provide port-a-johns and include all costs in base bid proposal. Contractors are prohibited from utilizing rest rooms within the facility unless permitted in writing from the Owner's representative during specific approved times when the facility is unoccupied.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 011000** 

## SECTION 011001 - GENERAL MEP/FP REQUIREMENTS

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 CONTENTS

- A. DESCRIPTION OF WORK
- B. DEFINITIONS
- C. PERMITS AND CERTIFICATES
- D. TAXES
- E. PATENTS AND ROYALTIES
- F. RULES, REGULATIONS AND CODES
- G. LOCAL CONDITIONS
- H. CONTRACT DRAWINGS
- I. SINGULAR NUMBER
- J. ALTERNATES
- K. MATERIALS AND EQUIPMENT
- L. INSTALLATION OF EQUIPMENT
- M. EQUIPMENT "QUICK SHIP"
- N. EQUIPMENT FOUNDATIONS
- O. MATERIALS AND EQUIPMENT SUBSTITUTIONS AND APPROVALS
- P. SLEEVES

## GSD-221-C

- Q. PIPING EXPANSION
- R. WATERPROOFING
- S. TEMPORARY HEATING & CONTRACTOR'S CONSTRUCTION FACILITIES
- T. MINOR DEVIATIONS
- U. SUPERVISION
- V. COORDINATION
- W. PROTECTION
- X. PROTECTION OF UNDERGROUND SITE UTILITY LINES
- Y. SCAFFOLDING AND HOISTING
- Z. SUBMITTALS, SHOP AND EQUIPMENT DRAWINGS
- AA. PHOTOGRAPHIC DOCUMENTATION
- BB. CLEANING AND PAINTING
- CC. LUBRICATION AND PACKING
- DD. ACCESS OF EQUIPMENT
- EE. ACCESS TO VALVES
- FF. ACCESS PANELS
- GG. FLOOR AND CEILING PLATES
- HH. TEMPERATURE CONTROL WIRING AND CONDUIT
- II. BELT GUARDS
- JJ. BELT DRIVES AND SHEAVES
- KK. VIBRATION ISOLATION
- LL. PROVISIONS FOR LATER INSTALLATIONS
- MM. PIPE SUPPORTS AND PIPE HANGERS
- NN. OPERATING AND MAINTENANCE MANUALS
- OO. INSTRUCTION OF OWNER'S EMPLOYEES
- PP. RECORD DRAWINGS

- QQ. CUTTING AND PATCHING
- RR. RUBBISH
- SS. TESTS
- TT. FIRE DAMPER INSPECTION/TESTING
- UU. GUARANTEE AND WARRANTY
- VV. 24 MONTH COMPREHENSIVE MAINTENANCE
- WW. REQUIREMENTS FOR ELECTRONIC COPIES
- XX. SUBSTANTIAL AND FINAL CLOSE-OUT REQUIREMENTS

## 1.3 DESCRIPTION OF WORK

- A. All labor, materials, fixtures, equipment, tools and service necessary for installation and adjusting of all mechanical and electrical equipment, piping, ductwork, conduit, etc., required shall be furnished and installed in compliance with Drawings and Specifications.
- B. The Drawings and Specifications shall be understood to cover a complete system of mechanical and electrical work, such as Heating, Ventilating, Air Conditioning, Refrigeration, Plumbing, Controls, and other as shown on the Drawings and specified under appropriate sections of the Specifications. The Drawings and Specifications shall be taken together. Work specified and not shown, or work shown and not specified shall be performed or furnished as though mentioned in both Drawings and Specifications.
- C. Unless otherwise specified, the Installer shall furnish all materials, tools, equipment, apparatus, appliances, transportation, labor, and supervision required to provide a complete and operational system.
- D. Contractor or Subcontractor shall provide minor items and accessories reasonably inferable (anything incidental) as necessary for the complete and proper operation of all systems.
- E. Skilled workmen shall perform all work.
- F. INDEMNIFICATION: The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.
- G. HAZARDOUS MATERIALS: Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor

shall, as a part of their work, ensure that his workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

- 1. Engineer have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, Engineer nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- 2. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.
- 3. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against Engineer, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold Engineer, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.
- 4. No asbestos or mercury containing materials shall be installed in this project.

### 1.4 DEFINITIONS

- A. "Provide" means furnish and install complete and ready to use.
- B. "Work" refers to labor or to material or both.
- C. All references to standard Specifications and Manufacturer's recommendations shall mean and intend latest edition of such Specifications adopted and published at date of publication of Contract Documents.
- D. Reference to technical societies, organizations, or bodies is made in Specifications in accordance with the following abbreviations:
  - 1. AGA: American Gas Association
  - 2. ANSI: American National Standards Institute
  - 3. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
  - 4. ASME: American Society of Mechanical Engineers
  - 5. ASTM: American Society for Testing and Materials.
  - 6. AWSC: American Welding Society Code.
  - 7. AWWA: American Water Works Association.
  - 8. FS: Federal Specification.
  - 9. IBC: International Building Code.
  - 10. NEC: National Electrical Code.
  - 11. NEMA: National Electrical Manufacturers Association
  - 12. NFPA: National Fire Protection Association.

- 13. SMACNA: Sheet Metal and Air Conditioning Contractor's National Association, Inc.
- 14. UL: Underwriter's Laboratories, Inc.
- 15. Also refer to "Reference Standards and Definitions" of the Specifications for further definitions.

## 1.5 PERMITS AND CERTIFICATES

A. Each installer shall make application and pay for all permits and certificates of inspection required by local, State, or Federal Governments, public utilities, or other authorities having lawful jurisdiction. Each shall deliver to the Engineer all certificates of inspections and approvals that may be required by such authorities.

#### 1.6 TAXES

A. Each Installer shall include in his proposal all applicable local, State and Federal taxes.

## 1.7 PATENTS AND ROYALTIES

A. Each Installer shall include in his proposal any and all fees and royalties that may be payable for installation or use of patented equipment, materials, or systems in the Work.

## 1.8 RULES, REGULATIONS AND CODES

- A. All work shall be performed or installed in strict accordance with applicable regulations and codes of local, state and federal governments, IBC, and other authorities having lawful jurisdiction. Each Installer shall be responsible for such compliance with the latest applicable Codes and Standards including, but not limited to, the following:
  - 1. West Virginia State Building & Fire Codes as adopted and in effect August 1, 2020.
  - 2. International Code Council (ICC 2015).
  - 3. American Society for Testing Materials (ASTM).
  - 4. American National Standards Institute (ANSI).
  - 5. National Fire Protection Association (NFPA).
  - 6. National Electrical Code (NFPA 70 2017).
  - 7. Life Safety Code (NFPA 101 2018).
  - 8. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  - 9. ASHRAE 90.1 2010 Energy Standards.
- B. All work must also have the approval of all West Virginia governmental authorities and agencies having jurisdiction over the project including, but not limited to, the following:
  - 1. West Virginia State Fire Marshal.
- C. Installers shall cooperate with and assist other installers on the job in conformity with all current trade jurisdictional rulings. He shall perform all work covered by the Drawings

and Specifications which properly comes under the jurisdiction of the trade he represents. He shall include such work of other trades that is incidental to his work or is specified to be included in his contract where his jurisdictional rules require the assistance of mechanics of his trade. In the handling of equipment furnished by others, or in the work of the other trades, each Installer shall provide such assistance.

- D. Where quantities, sizes, or other requirements of the Drawings and Specifications are in excess of applicable code requirements, the Installer shall comply with the Drawings and Specifications.
- E. The Installer shall include in the Work, without extra cost to the Owner; labor, materials, services, apparatus, and Drawings in order to comply with applicable laws, ordinances, rules and regulations.
- F. All materials and equipment for the electrical portion of the mechanical systems in all Divisions of the Specifications shall bear the approval label or shall be listed by the Underwriters' Laboratories, Inc. (UL).

## 1.9 LOCAL CONDITIONS

- A. Each Installer, prior to bidding, shall visit the site and shall determine all existing conditions affecting work in his contract. He shall examine all Drawings and Specifications to familiarize himself with the type of construction to be used and the nature and extent of the work of other trades. He shall determine how such construction or work will affect the installation of work in his contract.
- B. Each Installer shall observe the conditions under which deliveries of materials and equipment will be made and under which such materials and equipment can be stored. He shall include adequate provision for these, therefore, in his proposal.
- C. Failure to determine existing conditions or the nature of new construction, or the nature and extent of work to be performed by other trades, will not be considered a basis for the granting of additional compensation.

## 1.10 CONTRACT DRAWINGS

- A. The Contract Drawings show the arrangements and sizes of principal apparatus and devices to be provided under this Contract and the connections thereto. These Drawings shall be followed as closely as actual field conditions will permit.
- B. The Contract Drawings are diagrammatic and are not "As Built" conditions and are a graphic representation of the Contract requirements. Dimensions of work as indicated on the Drawings are not guaranteed to be as-built dimensions. No measurements shall be scaled from the Drawings and used as definite dimensions for layout or fitting work in-place.
- C. The layout of equipment, as shown on the Drawings, shall be checked and exact locations determined by dimensions of equipment approved by the Engineer. Do not make final layouts until Shop or Equipment Drawings are reviewed and job conditions

- verified. Where the fixtures and equipment are not definitely located, verify the information with the Engineer.
- D. The Installer shall consult all Drawings to determine the nature and extent of work of other trades that connect to or members with work under his Contract; and shall cooperate with the Installer of such work as necessary to achieve a complete, neatly fitted installation for each condition.
- E. The Installer shall follow Drawings in laying out work and check Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions at all points. Where headroom or space conditions appear inadequate, Engineer shall be notified before proceeding with installation.
- F. Without extra charge, the Installer shall make reasonable minor modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

## 1.11 SINGULAR NUMBER

A. Where any device or part of equipment is herein referred to in the singular number (such as "the HVAC unit") such reference shall be deemed to apply to as many such devices as are required to complete installation.

## 1.12 ALTERNATES

A. Examine all alternates and refer to Division 1 to determine effect of alternates on work in this section. Include cost of work under each alternate on bid form. See also the individual Specification Sections for further information.

## 1.13 MATERIALS AND EQUIPMENT

- A. All materials and equipment used shall be in accordance with Drawings and Specifications; models for which replacement parts are available; and shall have a service organization within a reasonable distance.
- B. Materials manufactured in the USA are preferred and any manufactured outside of the country shall be subject to review and acceptance by the Owner's representative and, in certain cases, by the Owner's insurance carrier. Pipe, pipe fittings, valves and selected other materials manufactured in China will not be acceptable for this Project.

## 1.14 INSTALLATION OF EQUIPMENT

A. All appliance and equipment shall be installed and connected in accordance with best engineering practice and in accordance with manufacturer's instructions and recommendations. Auxiliary piping, valves, and electrical connections recommended by the manufacturer, or required for proper operations, shall be furnished and installed complete at no additional cost.

## 1.15 EQUIPMENT "QUICK SHIP"

A. The Contractor shall include the cost in his BASE BID of any equipment that will require a premium "Quick Ship" cost to meet schedule. No change order will be permitted for quick ship costs.

#### 1.16 EQUIPMENT FOUNDATIONS

A. General Contractor shall provide concrete pad foundations for all floor mounted equipment unless indicated otherwise. Pad shall be four (4) inches high minimum, unless otherwise indicated on Drawings. All edges shall be chamfered one-inch.

## 1.17 MATERIALS AND EQUIPMENT SUBSTITUTIONS AND APPROVALS

- A. In these Specifications and on accompanying Drawings, there are specified and shown certain equipment, materials, and apparatus or other products most suitable for the service anticipated. Wherever manufacturer, brand name, type specify these materials, equipment, apparatus, or other products or catalog number, such designation is to establish standards of desired quality and style and shall be the basis for the bid or equal. This is not done to eliminate other equipment and materials of equal quality and efficiency. Any substitution request or alternate product/manufacturer must be submitted in writing and approved by the Engineer and the Owner prior to bidding to be considered acceptable for this project.
- B. Any substitution of material or equipment, other than those named in the Specifications, will be considered for one reason only: That the equipment proposed for substitution is superior or equal in construction and/or efficiency to that named in the Specifications and that high quality has been demonstrated by at least five years of service in similar installations.
- C. Acceptance or rejection of a proposed substitution shall be the privilege of the Engineer.
- D. If, prior to the execution of the Contract the Owner's and Engineer's approval is obtained for substitute equipment, the Installer shall, at his own expense, make any changes in the structures, building, piping, or electrical work necessary to accommodate the equipment and if additional engineering is required due to the substitution of other material or equipment, the Contractor shall pay the Engineer for such engineering service.

## 1.18 SLEEVES

A. Furnish and install sleeves for proper installation of work. Wall sleeves for up to 14 inches diameter shall be round metal boxes. Openings larger than 14 inches diameter shall be boxed out. After installation of pipes, ducts, etc. through sleeves, the Installer shall be responsible for filling completely between ducts, conduits or pipes and caulking opening completely to minimize sound transmission.

## 1.19 PIPING EXPANSION

- A. All piping shall be installed throughout the project with due regard for expansion, to prevent damage to the building, equipment, and piping. Anchors, loops or approved type expansion joints shall be provided for accurate control of movement.
- B. Bullhead connections in any piping service are expressly prohibited.

## 1.20 WATERPROOFING

- A. Where any work pierces waterproofing, including waterproof concrete, the method of installation shall be as approved by the waterproofing membranes instructions and by Engineer before the work is undertaken.
- B. Installer shall furnish all necessary sleeves, caulking, and flashing required making openings watertight.

## 1.21 TEMPORARY HEATING AND CONTRACTOR'S CONSTRUCTION FACILITIES

A. Temporary Utilities: The Mechanical / Electrical / Plumbing, etc., sub-contractors shall coordinate with the General Contractor on paying for utility services, where applicable. This includes temporary heat, telephone, fax, toilet facilities, etc. Also refer to Division 1, "Temporary Facilities and Controls."

#### 1.22 MINOR DEVIATIONS

- A. If equipment furnished differs in physical character from that specified or indicated, or where Contractor's provided equipment requires increased services and/or facilities to be provided by other trades, and if such is acceptable to Engineer, Contractor shall bear costs of modifying product to fit conditions shown, cost of modifying building to receive product, costs of increased services by other trades and including Engineering fees.
- B. Dimensions and ratings of equipment establish desired outlines and characteristics of equipment. Minor deviation will be permitted to allow manufacturers to bid on their nearest stock equipment.
- C. Manufacturers' catalog or model numbers and types are used as guides and are not to be interpreted as taking precedence over specific ratings or duty called for or shown. Manufacturers shall verify duty specified with the particular characteristics of equipment he intends to offer for review, offering only items that comply with Specification requirements.

## 1.23 SUPERVISION

A. Installer shall provide services of competent superintendent or foreman thoroughly familiar with all phases of work under his Contract with authority to act for his principals. Such superintendent or foreman shall not be removed without the consent of the

Engineer. However, if the Architect/Engineer finds that the superintendent is not competent, that superintendent shall be removed, and a competent superintendent shall be provided.

## 1.24 COORDINATION

- A. All Installers performing work on the project shall cooperate with each other as necessary to achieve a complete, neatly fitted installation for each condition. To that end, each Installer shall consult Drawings and Specifications for all trades to determine nature and extent of work specified in other sections, which adjoin or attach to his work, or to which his work attaches or joins. The Installer shall furnish to other trades, all necessary templates, patterns, settings, drawings, and shop details for the proper installation of work and for coordinating adjacent work.
- B. Any costs, repairs, and alterations of work-in-place which is made necessary by failure to observe this requirement for coordination shall be paid for by the Installer who fails.
- C. Each Installer shall confer with other Installers at the site to coordinate his work with theirs in view of job conditions, to the end that interference may be eliminated, and that maximum headroom and clearance may be obtained. If interferences develop, Engineer's decision will be final as to which trade shall relocate their work, and no additional compensation will be allowed for the moving of piping, ducts, conduit, or equipment to clear such interference.
- D. Coordination Drawings: Prepare coordination drawings according to requirements in individual Sections, and additionally if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- E. Coordination Drawings will be required and prepared for the following areas:
  - 1. Mechanical Equipment and Main Electrical Rooms.
  - 2. All areas where space conditions are tight with respect to the new construction as directed below.
- F. Coordination Drawings shall be prepared as follows:
  - 1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of structural, mechanical, and electrical systems.
    - b. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - c. Indicate required installation sequences. Indicate relationship of components shown on separate Shop Drawings.
  - 2. Number of Copies: Submit two hard copies and two electronic copies in PDF or CAD format (at the discretion of the Engineer) burned to a CD of each submittal. Engineer will return one electronic copy with any review comments:

- a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals (verify quantity of hard copies and electronic copies prior to submission). Engineer will retain one electronic copy; remainder will be returned. Mark up and retain one returned copy as a Project Record Drawing; place other copies in operation and maintenance manuals and save in electronic format for final issuance on CD.
- 3. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.
- G. Where the work of the Installer will be installed in close proximity, or will interfere with work of other trades, he shall assist in working out space conditions to make a satisfactory adjustment. Contractor shall prepare composite Working Drawings and sections at a scale not less than 1/4" = 1'-0" as required for coordination, clearly showing how his work is to be installed in relation to the work of other trades.
- H. The Contractor shall notify the Engineer of any conflicts as soon as they are known to determine the best resolution to the conflict at no additional cost to the Owner. Failure of the Contractor to coordinate the work of other trades shall place the responsibility for and subsequent corrective action / relocation of said work upon the Contractor.
- I. Unless otherwise stipulated under a particular heading, the following rules relative to responsibilities of several Installers shall apply:
  - Electrical Installer shall provide all starters and disconnects unless otherwise stipulated for specific item. All disconnects factory installed on equipment furnished by Mechanical Contractor shall be relocated by the Mechanical Contractor when required to meet field conditions and to meet NEC requirements at no additional cost to the Owner. All starters shall have HAND / OFF / AUTO switches and auxiliary contacts.
  - Each Installer furnishing motors shall be responsible for advising Electrical Installer
    of exact function of system to assure proper type of starter with correct number of
    auxiliary contacts for efficient operation of system. Motors 5 HP and larger shall be
    premium efficient type. All motors shall be provided with thermal overload
    protection.
  - 3. Each installer providing motors requiring pilot devices for automatic control shall furnish such devices with motor, to be wired by Electrical Installer. The Temperature Controls Installer shall wire electrical devices, such as thermostats furnished under Heating, Ventilating, and Air Conditioning, unless otherwise indicated in the Temperature Control Section of the Specifications.
  - 4. Electrical Installer shall provide wiring from current source to all starters and from starters to motors, except in the case of factory installed wiring in packaged equipment. Electrical Installer shall wire to the line side of pre-wired equipment. If a piece of equipment such as a Boiler is furnished and the control panel and disconnect is remotely mounted, the Electrical Contractor shall furnish and install all rough-in and final connections, wiring and conduit for a complete installation.
  - 5. The Installer furnishing and installing equipment shall furnish Dimensioned Drawings accurately locating all roughing-in required for his equipment.
  - 6. Door grilles shall be provided under another section of the Specifications.
  - 7. Flashing of curbed roof openings will be installed under another section of the Specifications, but Installer who installs work above the roof or deck shall do all counter flashing.

- 8. Each Plumbing, HVAC, and Electrical Installer shall install all rough-in pertaining to his trade for each item of equipment furnished under another section of the Specifications or by the Owner. Locations of the waste, vent, water, or heating supply, electrical outlets, for this equipment are indicated on the Mechanical and Electrical Drawings in their approximate locations. The installer furnishing and installing equipment shall furnish Dimensioned Drawings accurately locating all roughing-in for his equipment.
- 9. Plumbing, HVAC, and Electrical Installers shall make final connections of equipment to roughing-in as specified in appropriate sections of the Specifications.
- 10. Provide drip pans under water, soil, waste, return or drip piping which runs over electrical switchboards, transformers, or electrical motor starters. Each drip pan shall have a drain piped to discharge to nearest available open drain unless otherwise indicated.
- 11. Fixed louvers in exterior building walls not associated with the HVAC system will be provided under other sections of the Specifications unless otherwise noted. The mechanical contractor shall be responsible for providing all louvers associated with the HVAC system and as scheduled on the mechanical drawings. The Contractor or Subcontractor for HVAC shall provide dampers and shall make duct connections to each louver, blanking off all unused portions. Closures shall be insulated and weather tight. Connections shall be watertight and shall drain to outside.
- J. All appliances and equipment shall be installed and connected in accordance with the best engineering practice and in accordance with the manufacturer's instructions and recommendations. All auxiliary piping, water seals, valves, electrical connections, and controls, recommended by the manufacturer or required for proper operation shall be furnished and installed complete, without additional charge to the Owner.
- K. Where bulky equipment such as HVAC units or similar large items cannot be delivered or installed without unduly delaying concrete or masonry work, the Installer supplying such items shall arrange for leaving openings in floors, walls, or roofs as necessary for ingress thereof. He also shall arrange for the subsequent closing of the openings. All such arrangements for and closures of the openings shall be subject to Architect/Engineer's approval.

#### 1.25 PROTECTION

- A. In addition to provisions and stipulations set forth in other sections of these Specifications, each Installer shall provide various types of protection as follows:
  - 1. Protect finished floors from chips and cutting oil by the use of metal chip receiving pan and oil-proof floor covering.
  - 2. Protect equipment and finished surfaces from welding and cutting spatters with baffles and spatter blankets.
  - 3. Protect equipment and finished surfaces from paint droppings, etc., by the use of drop cloths.
  - 4. Use of solid fuel burning temporary heat appliances or of oil burning appliances without vents to the atmosphere is expressly prohibited.
  - 5. Provide covers for equipment such as electrical switchgear, hot water heaters, etc. to protect them from construction dust and debris. Covers must be Visqueen or equal.

- B. All motors, fans, and other rotating equipment shall be stored at site with openings, bearings, etc., covered to exclude dust and moisture.
- C. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside. Stored pipes shall be complete with end caps from dust and dirt entering the pipes.
- D. Protect flanges, fittings, and piping specialties from moisture and dirt.
- E. Store plastic pipes protected from direct sunlight. Support pipes to prevent sagging and bending.

## 1.26 PROTECTION OF UNDERGROUND SITE UTILITY LINES.

- A. All existing and/or new underground utility lines shall be properly protected against heavy traffic load such as cranes, bulldozers and other types of heavy equipment being moved over these areas. In areas where such heavy traffic is encountered, bridges shall be built at points over the trench best suited for the movement of heavy equipment as determined by the needs of the various Installers. The material used and method of construction shall be the responsibility of the General Contractor. The General Contractor shall also be responsible for the building and maintaining of these bridges.
- B. In addition to providing bridges over the pipe trenches at specific locations, stakes or markers will be set along the sides of the trenches, denoting the location of the back-filled trench. These markers will also be used to discourage the stockpiling of heavy construction materials over the pipe trenches.

## 1.27 SCAFFOLDING AND HOISTING

A. Each Installer shall pay all costs of transportation of materials and equipment to job site and include such costs in his proposal. Scaffolding and hoisting equipment shall comply with requirements of all pertinent Federal, State, and Local laws and Codes.

# 1.28 SUBMITTALS, SHOP AND EQUIPMENT DRAWINGS

- A. The Contractor shall prepare and submit to the Engineer, through the Prime Contractor and the Owner within thirty (30) days after the date of the Contract, required copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter. Refer to specifications for additional requirements for shop drawing submittal requirements.
- B. Provide all shops in electronic/PDF format. The Engineer's comments will be returned in electronic format.
- C. Each shop drawing and/or manufacturers descriptive literature shall have the proper notation indicated on it selecting equipment, accessories and features and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the

Engineer may readily determine what the Contractor proposes to furnish. All data and information schedules indicated or specified shall be noted on each copy of each submittal.

- D. Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.
- E. All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the Prime Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.
- F. The Contractor shall make any corrections or changes required by the Engineer and shall re- submit for final review as outlined above.
- G. It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the Contract Documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located. The Contractor shall also coordinate piping side connections.
- H. The Engineer's review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for adaptability of the item to the project; compliance with applicable codes, rules, regulations and information that pertains to fabrication and installation; dimensions. weight and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.
- I. Prior to ordering any materials or rough-in of any kind, the Mechanical Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor. There will be no change in the Contract Amount for any discrepancies. A final coordination meeting shall be held with the Architect, Owner, Engineer, Prime Contractor, Mechanical Contractor, Electrical Contractor and their sub- contractors.
- J. Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.
- K. If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the Drawings; and the Contractor shall be required to furnish all materials in accordance with this list.

- L. Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors unless noted otherwise on the Plans. Color samples shall be furnished with the shop drawing submission for such equipment.
- M. All submittals for mechanical equipment shall include all information specified and scheduled. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.
- N. All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.
- O. Any submittals received in an unorganized manner without options to be provided specifically noted and with incomplete data will be returned for resubmittal.
- P. If submittals are rejected twice, the Submitting Contractor shall be required to submit payment directly to the Engineer in the amount of \$1,500 (unless greater amount specified elsewhere) or the Engineer's time and material cost, whichever is greater, to pay the Engineer for his service before the re-submittal is reviewed. No time extension will be granted for project completion resulting from the submittals being rejected. In addition, for each re-submittal thereafter the Submitting Contractor shall be required to submit payment directly to the Engineer in the amounts stipulated above to pay the Engineer for his service.
- Q. Shop and equipment drawings shall comply as outlined under this division of the Specifications and as outlined in Division 1 of the Specifications. Where discrepancies occur, this section shall take precedence.
- R. Within thirty (30) days after receipt of the "Notice to Proceed", the Installer shall submit to the Engineer for approval two (2) electronic copies in PDF format on CD or DVD or other media as approved by the Engineer (or number to be determined at preconstruction meeting) of a complete list of items that he proposes to use in the project. Consideration will not be given to partial lists submitted from time to time.
- S. List shall include the following:
  - 1. Manufacturer and trade name.
  - 2. Catalog data.
  - 3. Catalog number and size.
  - 4. Capacity.
  - 5. Performance curves and other information sufficient to identify each item.
  - 6. Specification Number and Paragraph.
- T. Outline dimensions, operating and maintenance clearance, and sufficient engineering data to indicate compliance with the Specifications.
- U. Identify each piece of equipment submitted by mark number as shown on schedules. Catalog data shall include model numbers, trade names, performance data, and descriptive data.

- V. Submit fabrication and/or installation drawings for ductwork throughout the building.
- W. Brochures, shop drawings, and related items shall be submitted together or in closely coordinated, related groups of equipment.
- X. Submittal drawings shall be marked with the project name and Specification number, consecutively numbered and bear stamp of approval of Installer as evidence that:
  - 1. Installer has inspected such drawings, cuts, and schedules.
  - 2. Material or equipment covered will meet Specification requirements.
  - 3. Material or equipment will fit properly in the building and member with work of other trades.
  - 4. Each item is complete, or that the missing elements have been provided from another source.
- Y. Submittal to the Engineer shall be made only after Installer has inspected drawings, cuts, schedules, etc., and determined that material or equipment submitted meets specified requirements and will fit properly and coordinate properly with other work.
- Z. Equipment shall not be purchased, delivered to site, nor installed until the submittals have been reviewed and accepted by the Engineer.
- AA. All mechanical and electrical items submitted for review shall be items that, on the date of opening bids, have been in successful commercial use and operation for not less than five (5) years in projects and units of comparable size. Right is reserved by the Engineer to require Installer to submit list of buildings in which they are in operation so that investigation, as may be deemed necessary, may be made before review.
- BB. Any equipment submitted not complying with the requirements of this section shall be considered as rejected. No extension of time over completion date will be allowed to Installer due to rejected equipment.
- CC. Review that is granted on shop drawings is rendered as a service only and shall not be considered as a guarantee of measurements of building conditions, nor shall it be construed as relieving the Installer of basic responsibilities under the Contract. When drawings are reviewed, said review does not in any way relieve the Installer from his responsibility or necessity of furnishing material meeting requirements of performance or performing work as required by the Contract Drawings and Specifications.
- DD. Submittal review by the Engineer shall not relieve the Installer of responsibility for the following:
  - 1. Submittal errors or omissions.
  - 2. Deviations from the Contract documents, without prior written approval from the Engineer, shall not be made.
- EE. Items which take a longer period of time, such as Control Drawings may be submitted to Engineer at a later date, however, the Control Drawing Submittals shall be listed in the Table of Contents.

- FF. Electronic copies of the submittals (PDF format) shall be submitted to the Engineer for review. The electronic copies shall be organized similar to as described with individual folders serving as tabs and shall include the Submittal Cover Sheet. Electronic submission requirements are as follows:
  - 1. All submittals must be issued for review within thirty (30) calendar days after contractor's notice to proceed except as indicated below or otherwise noted and agreed upon.
  - 2. Contractor shall provide the submittals on CDs or DVDs. Submissions shall be organized by discipline, trade, etc. and shall be complete; partial submissions will not be accepted; email submissions shall not be acceptable unless noted otherwise and as approved by the Engineer.
  - 3. No submittals will be accepted without a Submittal Cover Sheet and signed Contractor stamp of approval for each submittal.
  - 4. For any item(s) requiring a long delivery schedule, submittals shall be issued separately within ten (10) calendar days after notice to proceed is given to the contractor. Emailed submittal of long delivery items may be acceptable provided the contractor receives a "confirmation of acceptance" from the Engineer.
  - 5. It is understood that temperature controls, for example, take more time to compile and that is acceptable; the contractor shall prepare a folder on the CD for any items not included in submittals and indicate when they will be available to the Engineer. Email submission of delayed submittal may be acceptable provided the contractor receives a "confirmation of acceptance" from the Engineer.

## 1.29 PHOTOGRAPHIC DOCUMENTATION

- A. The Contractor(s) shall provide the following and include all costs in Base Bid proposal:
  - 1. Periodic MEP construction photographs.
  - 2. Photographs of all MEP work that is to be concealed.
- B. Construction Photographs: Submit each photographic view electronically within seven days of taking photographs:
  - 1. Format: Digital, electronic dated pictures.
  - 2. Identification: On each photograph include the following information:
    - a. Name of Project.
    - b. Name of Contractor.
    - c. Date photograph was taken if not date stamped by camera.
    - d. Description of vantage point, indicating location of area picture is taken from.
    - e. Unique sequential identifier.
  - 3. Digital Images:
    - a. Submit a complete set of copyright free and royalty free digital image electronic files as a Project Record Document on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.
    - b. Provide images in uncompressed JPEG format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1024 by 768 pixels.
  - 4. Periodic Construction Photographs:

- a. Select vantage points to show status of construction and progress since last photographs were taken.
- 5. Concealed Work Photographs:
  - a. All MEP work that will be concealed within construction elements shall be documented with photographs prior to concealment.

## 1.30 CLEANING AND PAINTING

- A. Daily or more frequent as the work requires clear away all debris, surplus materials resulting from work or operations, leaving job and equipment furnished in a clean condition.
- B. Air clean surfaces of all coils, fan housings, fan wheels, fan motors, air unit plenums, and all permanent filters shall be wiped clean or washed leaving installation in a first-class condition. Where throwaway filters are used, they shall be new when building is turned over to the Owner.
- C. Field painting of Mechanical and Electrical equipment, structural steel pipe supports, piping, conduit, ducts, but not touch-up painting of equipment and piping identification is by the Prime Contractor. The installer shall coordinate the work with all trades affected.
- D. Where factory finishes are provided on equipment and no additional field painting is specified, all marred or damaged surfaces shall be touched up or refinished by this Installer so as to leave a smooth, uniform finish at time of final inspection. Sheetmetal ductwork behind all grilles, registers, diffusers, which is exposed to view through the units, shall be given one coat of primer and finish coat of dull black paint by the Mechanical Contractor when requested by Owner/Engineer.
- E. If the equipment is so marred as to exclude touch-up, the equipment (Mechanical and Electrical) shall be completely painted.
- F. All newly installed exposed structural steel pipe supports, etc. shall be prime painted and shall have two (2) coats of finish paint.
- G. Unless otherwise specified under other sections of these specifications, the following items shall be painted:
  - 1. All exposed piping, valve bodies and fittings (bare and insulated), including hangers, platforms, etc.
  - 2. All mechanical equipment not factory finished. Aluminum and stainless-steel equipment, motors, identification plates, tags, etc. shall not be painted. All rust and foreign matter shall be thoroughly removed from surfaces prior to painting. All baked enamel factory finish of equipment which may have been scratched or chipped shall be touched up with the proper paint as recommended and supplied by the manufacturer.
  - 3. All ductwork exposed in finished areas (bare and insulated), all grilles, diffusers, etc. not factory finished. Paint the inside surfaces of all interior duct surfaces visible from any register, grille or diffuser opening on all jobs; surfaces shall receive one (1) prime coat of Rustoleum 1225 red "galvinoleum" or other approved equivalent primer and rust inhibitor and one (1) coat of Rustoleum 1579 jet black "Speedy

- Dry" enamel or approved equivalent applied in accordance with the manufacturer's recommendations.
- 4. All insulated piping, ductwork and equipment shall be properly prepared for painting by the Contractor where mechanical items are to be painted. In the case of externally insulated duct and pipe, the Contractor shall provide 6 oz. canvas jacket with fire retardant lagging. The jacket shall be allowed to dry properly before applying paint to avoid shrinking after painting and exposing unpainted surfaces. The Contractor, at his option, may provide double wall ductwork in lieu of externally insulated ductwork with canvas jacket and lagging.

## 1.31 LUBRICATION AND PACKING

- A. All rotating and reciprocating equipment that requires lubrication shall be lubricated with correct grade, type, and quantity of lubricant before being placed in service. Each shaft containing a packing gland shall be checked for condition by back packing gland off, and examining for proper grade, amount, and type of packing as recommended by manufacturer. Any item requiring lubrication shall be provided with grease-fitting extension so it can be lubricated from outside unit.
- B. Maintain all lubrication, gaskets, and packing during construction, and assure that at time of acceptance by the Engineer, all are in operating condition.
- C. Grease fittings shall be extended outside of equipment to allow for proper maintenance.

## 1.32 ACCESS OF EQUIPMENT

- A. All equipment, accessories, and piping shall be installed to permit access to all items of equipment requiring maintenance. The Installer shall verify prior to installation of equipment that maintenance can be performed on all of the equipment to be installed. Easy access shall be maintained to filters, motors, and drives. It shall be the Installer's responsibility to install all such equipment and accessories, arranging piping, ducts, and conduits to facilitate maintenance.
- B. Any relocation of pipes, ducts, etc. required to permit normal maintenance shall be done by the Installer at request of Engineer and shall be the responsibility of the Installer at no extra cost to Owner. All Code-required clearances shall be planned for and maintained as part of the Contractor's installation requirements.

#### 1.33 ACCESS TO VALVES

A. Valves that are more than 6 feet 6 inches from the floor to centerline or valves that are not readily accessible due to proximity of other equipment shall be provided with extension stems, to facilitate operation.

## 1.34 ACCESS PANELS

- A. Where valves, traps, balancing dampers, fire dampers, junction boxes or other specialties are concealed in the construction or behind a wall or ceiling surface, the Contractor installing each item shall coordinate with the Prime Contractor to furnish and install an access panel of adequate size to permit adjustment or service of concealed device. Panels shall be of a design suitable for installation in material forming the finished surface in which each is mounted. Access panels installed in fire-rated construction shall have a fire rating equal to or greater than the surface in which they are installed. Access panels shall not be required in lay-in type ceilings. The installer of the above items shall coordinate with the lay-in type ceiling Installer so that the T-bars can be properly marked to identify the concealed items. The Engineer shall approve the markers.
- B. Each Installer shall confer with other Installers with respect to access panel locations; group valves, traps, junction boxes and dampers in such a way as to be accessible from a single panel to eliminate as many access panels as possible.
- C. If access panels are not specified elsewhere, the Installing contractor shall provide access panels in masonry, gypsum or plaster surfaces having a flush metal frame with a flush hinged steel door with key cylinder-operated latch and minimum of four (4) tamper-resistant screwdriver-operated latches to provide a tamper resistant installation, unless noted otherwise in the contract documents. All access panels shall be keyed alike. In locations where equipment or devices require more than hand/arm access, access panels shall be a minimum of 24"x24" in size.
- D. Metal access panels shall be manufactured by Milcor, Knapp, or approved equal, and approved by the Engineer/Architect.

#### 1.35 FLOOR AND CEILING PLATES

- A. On all pipes and conduit passing through floors, walls, partitions, plaster, furring, or where exposed to view in occupied areas, provide approved steel plates. In finished rooms these plates shall be chrome plated; in unfinished rooms these plates shall be black iron, prime coated.
- B. Where electrical conduit or pipes pass through floors and are grouped in such a way that escutcheon plates cannot be applied, an Engineer approved four-inch curb shall be constructed to house these conduits or pipes and filled with concrete (or other method approved by the Engineer).

## 1.36 TEMPERATURE CONTROL WIRING AND CONDUIT

A. Temperature control wiring and conduit (unless otherwise indicated on the drawings and Control sections of specifications) shall be the responsibility of the Controls Contractor. All wiring and conduit, including power wiring, required for the automatic temperature control system to be fully functional shall be the responsibility of the Controls Contractor, and all costs shall be included in their proposal. B. The Controls Contractor shall engage an Electrical Contractor to provide all power wiring, conduit and boxes required for the automatic temperature control system to be fully operational. Power wiring associated with the automatic temperature control system indicated on the electrical drawings is considered part of the Electrical Contractor's scope of work and shall be included in their proposal. All costs for additional power wiring not indicated on drawings and required for controls shall be included as part of the Controls Contractor's proposal.

## 1.37 BELT GUARDS

A. Each belt drive or exposed motor shaft and coupling shall be equipped with a guard. Guards not furnished as part of the factory-made unit shall be constructed of No. 12 United States Standard Gauge 3/4" diamond-mesh wire screen or equivalent welded to one-inch steel angle frames and shall enclose all belts and sheaves. Tops and bottoms of guards shall be of sheet metal of not less than No. 18 United States Standard Gauge. Motor ends of Guards shall each be provided with a bolted angle joining, so that the motor sheave can be exposed for adjustment without removal of entire guard.

#### 1.38 BELT DRIVES and sheaves

- A. For each item of belt-driven equipment, provide an adjustable drive sheave with adjustment limits plus or minus 12-1/2 percent and based on a service factor of 1.2 as applied to the motor nameplate rating. Drives for one horsepower and over shall have at least two belts and all multiple belt sets shall be matched.
- B. Once the system has been balanced, the Mechanical Contractor shall provide permanent non-adjustable sheave. The variable pitch sheaves shall be turned over to the Owner.
- C. Contractor shall provide the Owner one (1) set of spare belts for each type of equipment. Belt shall be sized to fit Mechanical Contractor provided permanent non-adjustable sheaves. If a motor has two (2) belts on a sheave it shall be considered as one set of spares.

## 1.39 VIBRATION ISOLATION

A. A.Isolation units shall be selected with proper consideration of the prevailing machine frequencies and guaranteed by the manufacturer to prevent transmission of objectionable noise or vibration to the building structure. Isolation units shall be resistant to or protected from deterioration caused by oil or water. All motorized mechanical equipment suspended or floor mounted shall be isolated from structure by means of vibration isolators. Isolation material shall be provided under full length and width of equipment rails as applicable.

## 1.40 PROVISIONS FOR LATER INSTALLATIONS

- A. Where any mechanical or electrical work cannot be installed as the structure is being erected, Installer for such work shall provide and arrange for the building in of boxes, sleeves, inserts, fixtures, or devices as necessary to permit installation of the omitted work during later phases of construction. Such Installer shall arrange for and lay out chases, holes, or other openings that must be provided in masonry, concrete, or other work.
- B. Refer to Divisions 21, 22, 23 and 26 Section "Sleeves and Sleeve Seals for MEP/FP Piping, Raceways and Cabling" for requirements.

## 1.41 PIPE SUPPORTS AND PIPE HANGERS

A. Piping supported from floor shall have 1/4" steel plate on 2" concrete housekeeping pad. Pipe support and plates shall be painted. Pipe supported from floor shall not interfere with accessibility of equipment.

## 1.42 OPERATING AND MAINTENANCE MANUALS

- A. In addition to maintenance manuals and instructions procedures and requirements set out in other Divisions, the following shall apply:
- B. Bound Instructions When the project is 50% complete the Contractor shall submit to the Engineer completed "smart" PDF file(s) indexed and tabbed or other approved electronic media by Engineer/Architect for review and comment then once comments are addressed provide both electronic and bound volumes containing the manufacturer's operating and maintenance instructions for each piece of equipment in quantities requested. Manufacturing advertising literature or catalogs will not be acceptable for operating and maintenance instructions. Each set shall be permanently bound and shall have a hard cover. NOTE: Provide three (3) sets unless otherwise instructed at the Pre-Construction Meeting. Also provide one electronic copy for the Owner:
  - 1. The following identification shall be inscribed on the cover: the words "OPERATING AND MAINTENANCE INSTRUCTIONS," the name of the project, the name or identification of the equipment or system covered by the instructions, the name of the building, the name of the Contractor and the Contract number.
  - 2. Flysheets shall be placed before instructions covering each subject. The instruction sheets shall be approximately 8-1/2 inches X 11 inches with large sheets of Drawings folded in. The Instructions shall be complete and shall include, but not be limited to, the following:
    - a. System layout showing piping, valves, and controls.
    - b. Approved wiring and control diagrams.
    - c. A control sequence describing startup, operation, and shutdown.
    - d. Operating and maintenance instructions for each piece of equipment, including lubrication instructions.
    - e. Manufacturer's bulletins, cuts, and descriptive data.
    - f. Part lists and recommended spare parts.

- C. Framed Instructions: Frame the following information under glass or in approved laminated plastic and post where directed.
  - 1. Approved wiring and control diagrams showing the complete layout of the entire system, including equipment, piping, valves, and control sequence.
  - 2. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safety starting and stopping the system. Type the instructions and procedures and frame as directed above and post beside the diagrams.
  - 3. Proposed diagrams, instructions, and other sheets shall be submitted for approval prior to posting.
  - 4. The framed instructions shall be posted before acceptance of the systems.
  - 5. Copies of the original Engineer's drawings will NOT be acceptable.
- D. Field Instructions: The services of one or more competent person(s) shall be provided by the Installer for a period of not less than one day, unless otherwise specified, to instruct a representative of the Owner in the operation and maintenance of the system, upon completion of the Work and at a time designated by the Engineer, these field instructions shall cover all the items contained in the bound instructions:
  - 1. Field Instructions shall be videotaped and 2 copies of video on DVD or other approved media shall be turned over to the Owner.
- E. Contractor shall deliver all such materials no later than 60 days before the start of operation by the Owner or any instruction period hereinafter specified.

## 1.43 INSTRUCTION OF OWNER'S EMPLOYEES

- A. Furnish, without additional expense to Owner, the services of competent instructors who will give full instructions in the care, adjustment, and operation of all parts of mechanical and electrical equipment. This instruction shall be given to the Owner's employees who are to have charge of the equipment. Give at least seven days' notice to the Owner in advance, informing him of the above instructions.
- B. Each instructor shall be thoroughly familiar with all parts of the installation on which he is to give instruction, trained in operating theory as well as in practical operation and maintenance work. Factory-trained instructors may be employed wherever they are available.
- C. Instruction shall be given during the regular workweek after the equipment has been accepted and turned over to the Owner for regular operation. The number of man-days (eight-hour) of instruction furnished for each system shall be specified in other sections of these Specifications, but in no case less than one-man day, unless otherwise specified. All training for major mechanical and electrical systems (including HVAC controls) shall have a minimum of 1-day follow-up training at 6 months after facility turnover. All training shall be recorded in high-quality video and audio, permanently copied to DVDs bearing labels to indicate training sessions included and turned over to the Owner and electronically provided in a format approved by/to Engineer/Architect. Provide a minimum of two (2) copies of each DVD.

- D. The Contractor shall review component of each kind of equipment, how it operates, how to maintain it, how to repair it, etc. Contractor shall prepare a report of the Operating and Maintenance meeting, when it was completed and shall include the sign-in sheet of all parties in attendance:
  - 1. On Sign-In Sheet, include a checkbox with the wording "Satisfied with Training?" or "Not Satisfied with Training?" for each participant to mark. Submit the Sign-In Sheet to the Engineer/Architect with the Report.
  - 2. Refer also to Division 1, "Demonstration and Training."

# 1.44 RECORD Drawings

- A. Each Installer for Mechanical or Electrical Work shall keep on the job one complete set of Contract working drawings on which he shall record any deviations or changes from such Contract Drawings made during construction. Record shall show changes in:
  - 1. Size, type, capacity, etc. or any material, device or piece of equipment;
  - 2. The location of any device or piece of equipment;
  - 3. Routing of any piping, conduit, ducts, or other services.
- B. These Record Drawings shall also record the location of all concealed electrical service, water piping, vents, ducts, electrical junction boxes, conduit and other piping, by indication of measured dimensions to each such line from readily identifiable and accessible walls or corners of building.
- C. These Record Drawings shall be kept clean and undamaged and shall not be used for any purpose other than recording deviations from working drawings and exact locations from concealed work.
- D. In addition to the above, the Installers shall prepare three (3) sets of Record Drawings on good quality paper and two (2) electronic copies on DVD or other approved media (PDF format or format approved by Engineer) to be turned over to the Architect/Engineer or Owner as directed by the Architect/Engineer. Pre-Construction meeting may modify the number required. Provide an electronic copy ("smart" PDF or other approved format) to Engineer and Owner for review prior to finalizing the Record Drawings.
- E. AUTO CAD or Revit files on a CD disk of the Bid Document Drawings may be purchased from the Engineer at their cost plus 25% providing a "Release of Liability" is executed between Engineer and Contractor. It is at the option of the Installer to supply his own drawings with work completed to date. Record Drawings furnished by the Installer shall be submitted to the Engineer for approval.

## 1.45 CUTTING AND PATCHING

A. Each Installer shall be responsible for all cutting and patching of building materials, ductwork, piping, conduit, etc., as required for installation of his work, but no structural members shall be cut without approval of Engineer and any such cutting shall be done in a manner directed by Engineer.

B. All patching of or repair of damage to work in place shall be done in a neat and workmanlike manner, meeting with approval of the Engineer. Any installer whose operations require cutting of work in place, or who causes damage, which entails repairs of such work, shall employ mechanics of particular trade whose work must be cut or which is damaged, and pay all costs of such patching or repair.

## 1.46 RUBBISH

- A. All rubbish resulting from the Work herein specified shall be removed from premises by the trade that produced it, as fast as it accumulates.
- B. Upon completion of this Work, each Installer shall remove from the site, and see that each of his Subcontractors removes, all tools, equipment, surplus material, and rubbish pertaining to his own operations. Each Contractor or Subcontractor shall pay all cost for such removal and disposition.

#### 1.47 TESTS

- A. Test all equipment installed and demonstrate its proper operation to the Owner's Representative. No equipment shall be tested or operated for any other purpose, such as checking motor rotation, until it has been completely lubricated in accordance with manufacturer's instructions.
- B. All tests shall be conducted in the presence of the Engineer or the Owner's Representative.
- C. Notify Owner's Representative at least 48 hours in advance of scheduled test. Tests performed without proper notification of Owner's Representative shall be run again in Owner's Representative's presence.
- D. If tests show that the Work is in any way defective or at a variance with the Specification requirements, the Installer shall immediately make all changes found necessary by the Owner's Representative. In the event the Installer does not (within a reasonable time) remedy all defects and make all changes demanded by the Owner's Representative to complete the work satisfactorily, the right is reserved to have defects remedied or changes made and to charge the cost of the same amount against the installer.
- E. All tests shall be documented in writing by the installer and copies given to Engineer and Owner.

## 1.48 FIRE DAMPER INSPECTION/TESTING

A. Existing fire dampers shall be tested per NFPA 80 "Standard for Fire Doors and Other Opening Protectives", Chapter 19 "Installation, Testing and Maintenance of Fire Dampers". Testing will comply with the requirements of the office of the West Virginia State Fire Marshal and other Authority Having Jurisdiction (AHJ). In addition, per NFPA 80, new fire dampers shall be inspected and tested one (1) year after initial installation by this contractor.

- B. In general, inspection and testing procedures shall be as follows:
  - 1. Full unobstructed access to the fire or combination fire/smoke damper shall be verified and corrected as required.
  - 2. If the damper is equipped with a fusible link, the link shall be removed for testing to ensure full closure and lock-in place if so equipped.
  - 3. The operational test of the damper shall verify that there is no damper interference due to rusted, bent, misaligned, or damaged frame or blades, or defective hinges or other moving parts.
  - 4. The damper frame shall not be penetrated by any foreign objects that would affect fire damper operations.
  - 5. The damper shall not be blocked from closure in any way.
  - 6. The fusible link shall be reinstalled after testing is complete.
  - 7. If the link is damaged or painted, it shall be replaced with a link of the same size, temperature, and load rating.
  - 8. All inspections and testing shall be documented indicating the location of the fire damper or combination fire/ smoke damper, date of inspection, name of inspector, and deficiencies discovered.
  - 9. The documentation shall have a space to indicate when and how the deficiencies were corrected.
  - 10. All documentation shall be maintained and made available for review by the AHJ.
  - 11. Reports of changes in airflow or noise from the duct system shall be investigated to verify that they are not related to damper operation.
  - 12. All exposed moving parts of the damper shall be dry lubricated as required by the manufacturer.
  - 13. If the damper is not operable, repairs shall begin without delay.
  - 14. Following any repairs, the damper shall be tested for operation in accordance with these requirements.
  - 15. All maintenance shall be documented in accordance with items 8, 9 and 10 above.

### 1.49 GUARANTEE AND WARRANTY

- A. In addition to Guarantee and Warranty procedures and requirements set out in the General Conditions, the following shall apply:
  - 1. Each Installer shall guarantee all work that is installed by them or their sub-installer to be free from defects in material and workmanship for a period of two (2) years following the date of Substantial Completion, unless a longer period is stipulated under specific Specification sections and he shall repair or replace at no additional cost to the Owner any material or equipment developing defects. The Owner purchased equipment will include two-year parts/labor only warranty. Repairs or replacements shall bear an additional 2-year guarantee, as originally called for, and dated from the final acceptance of the repair or replacement. This requirement shall be binding, even though it may exceed product guarantees normally furnished by some manufacturers:
    - a. Compressors require an extra three (3) years beyond second year warranty.
  - 2. Each Installer shall submit his own as well as each equipment manufacturer's written certificates, warranting that each item of equipment furnished complies with all requirements of the Drawings and Specifications.

- 3. Note that the guarantee shall run from date of Substantial Completion, not from the date of installation or shipment of a device or piece of equipment.
- 4. Refer also to other Specification sections for additional warranty requirements. If any discrepancies are found in requirements between the sections, contact Engineer/Owner for direction prior to bidding.

## 1.50 COMPREHENSIVE MAINTENANCE/WARRANTY

- A. The intent is for the Mechanical Contractor to provide comprehensive maintenance for all new/existing HVAC equipment to be reused and accessories installed under this project for 24 months from substantial completion. The Contractor shall identify the cost associated with providing the 24-month comprehensive maintenance as a separate line item on the application of payment and payment may be withheld until all work is completed under this requirement.
- B. A binder containing logs of all work shall be maintained at the facility to be reviewed at any time. Work logs shall contain the date on site, time of arrival, time of departure and work performed during the site visit. Contractor shall obtain signature of Owner's representative on daily logs to document site visits.
- C. Contractor shall coordinate all warranty requirements with equipment manufacturers, controls companies, etc. and provide a blanket coverage for any work not covered under other sections regardless if it exceeds manufacturer warranties for parts and labor. All coordination and scheduling during the comprehensive maintenance/warranty shall be the responsibility of the Mechanical Contractor through discussions and/or correspondence directly with the Owner. If the Engineer must get involved with coordinating the maintenance/warranty work with any Contractors/Suppliers during the period following Substantial Completion, then the responsible Contractor/Supplier shall reimburse the Engineer for Engineer's efforts on a Time and Material basis. Engineer shall make sole determination as to which Contractor/Supplier is responsible for reimbursement to the Engineer.
- D. A brief description of work includes, but is not limited to, the following scope of work:
  - 1. Report in with the Owner's Representative.
  - 2. Record and report abnormal conditions, measurements taken, maintenance work performed, etc.
  - 3. Review logs with the Owner for operational problems and trends.
  - 4. General: If deficiencies are found during verifications, the contractor shall coordinate replacement, adjustments and repairs as a service covered under the comprehensive maintenance. Coordinate repairs if they are considered warranty issues. Items which require routine replacement, such as air filters, belts, etc., shall be considered as part of the services covered under the comprehensive maintenance and will be replaced at regular intervals, but will not be required to be replaced on a daily or weekly basis. Excess stock of lamps, filters, belts, etc. shall be tagged for comprehensive maintenance and stored onsite for the Owner's maintenance personnel to perform replacement of items that cannot be deferred until the contractor is onsite:
    - a. Inspect for leaks and report leak check results.
    - b. Repair minor leaks as required (e.g. valve packing, flare nuts).

- c. Calculate refrigerant loss rate and report to the Owner.
- d. Check the sheaves and pulleys for wear and alignment.
- e. Check the belts for tension, wear, cracks, and/or glazing.
- f. Verify proper damper operation.
- g. Check mechanical linkages for wear, tightness, and clearances.
- h. Verify clean air filters, replace as necessary.
- i. Verify the operation of the crankcase oil heater(s), if applicable.
- j. Verify correct and smooth wheel drive operation.
- k. Check wheel for cleanliness. Clean as necessary.
- I. Verify proper operation of VFD's. Repair as necessary.
- m. Verify clean condenser and evaporator.
- n. Verify clean evaporator fan.
- o. Comply with manufacturers recommended service and maintenance.
- 5. Controls and Safeties:
  - a. Verify the operation of the discharge air temperature control device, if applicable.
  - b. Verify the operation of the outside air temperature control device.
  - c. Verify the operation of the mixed air temperature control device.
  - d. Test the operation of the high condenser pressure safety device. Calibrate, if necessary, and record setting.
  - e. Test the operation of the low temperature safety device. Calibrate, if necessary, and record setting.
  - f. Test the operation of the low pressure safety device(s). Calibrate, if necessary, and record setting.
- 6. Lubrication:
  - a. Lubricate motor bearings, if applicable.
  - b. Lubricate fan bearings.
  - c. Check oil level in the compressor(s), if applicable.
- 7. Motor and Starter:
  - a. Clean the starter and cabinet.
  - b. Inspect wiring and connections for tightness and signs of overheating and discoloration.
  - c. Check the contactors for free and smooth operation.
  - d. Meg the compressor motor(s) and record readings.
  - e. Verify the tightness of the compressor motor terminal connections.
  - f. Verify the operation of the crankcase oil heater(s), if applicable.
- 8. Startup and Checkout Procedure:
  - Start the unit.
  - b. Verify the starter operation.
  - c. Verify the smooth operation of the compressors and fans.
  - d. Log operating conditions of the unit after the system has stabilized.
  - e. Review operating procedures with operating personnel.
  - f. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
- 9. Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected or warranty issues to be coordinated.
- E. A minimum of two (2) weeks prior to Substantial Completion, the Contractor shall submit bound copies of a "Preventive Maintenance Manual" for review and comment by the Owner. This manual shall be divided into Specification Divisions for Mechanical (HVAC)

and Electrical and individual equipment/systems' forms shall be in Contractor's customary format. The final version of this manual as accepted by the Owner shall be provided to the Owner in two (2) bound hard copies and two (2) CD's in a PDF format or other approved format for their records:

- The Preventive Maintenance (PM) Manual shall be utilized by the contractor in performing the comprehensive maintenance activities and a bound log shall be kept on site. As part of the maintenance process, the contractor shall update the forms and the final version provided to the Owner with any information that is found to be different than originally submitted.
- 2. The Preventive Maintenance Manual shall include detailed forms for each system or piece of equipment identifying all manufacturers recommended preventive maintenance items, as well as Code required maintenance tasks. As a minimum, the forms shall include the following information for each piece of equipment/system:
  - a. Equipment Type (Boilers, pumps, etc.)
  - b. Drawing Identification Mark (AHU-1, F-11, etc.)
  - c. Maintenance Task and frequency
  - d. Part Numbers for replacement components, such as belts, filters, etc.
- 3. Systems and equipment to be included in the PM Manual includes, but is not limited to:
  - a. Mechanical (HVAC):
    - 1) Hydronic Water Systems (boilers, pumps, controls, valves, etc.).
    - 2) Air-handling units and all associated components.
    - 3) Exhaust fans.
    - 4) Hydronic piping system components (strainers, valves, etc.).
    - 5) DDC system.
    - 6) Fire Dampers.

## 1.51 REQUIREMENTS FOR ELECTRONIC COPIES

- A. The contractor shall provide electronic copies in addition to hard copies of all submittals and reports. They shall be PDF or in a format pre-approved by Engineer. Electronic copies shall be provided for, but not limited to, the following:
  - 1. Submittals (On a CD or DVD or emailed as approved by Engineer with hard copies).
  - 2. Meeting Minutes.
  - 3. Application for Payment.
  - 4. Testing, Adjusting and Balancing Reports (On a CD or DVD or emailed as approved by Engineer).
  - 5. Record Drawings (On a CD or DVD or emailed as approved by Engineer with Record Drawings/ hard copies).
  - 6. O. & M. Manuals (On a CD or DVD or emailed as approved by Engineer with bound O. & M.'s / hard copies).
  - 7. Change Orders.
  - 8. RFI's.
  - 9. Closeout Documents.

## 1.52 SUBSTANTIAL AND FINAL COMPLETION REQUIREMENTS

- A. The Contractor and Owner shall complete the forms below to establish dates for Substantial and Final Completion of the Project:
  - 1. Substantial Completion Requirements: (Contractor shall provide a letter signing off that all items below have been completed, substantial completion will not be approved until this has been received by the Engineer/Owner)
    - a. Prior to Substantial Completion the Contractor shall provide to the Engineer a punch-list of items that need to be completed on the Project. List shall be submitted a minimum of seven (7) days prior to the Engineer's scheduled walkthrough.
    - b. O&M Manuals are required to be submitted to Engineer for review at 50% completion of the Project. Substantial Completion will not be established without Engineer's review and acceptance.
    - c. Preventive Maintenance (PM) Manuals (when applicable) shall be submitted to Engineer for review a minimum of two (2) weeks prior to the proposed Substantial Completion date.
    - d. Spare parts/Extra Materials shall be turned over to the Owner with a complete list of items provided. Owner's receipt and acceptance must be documented.
    - e. Record Documents (drawings, specifications' markups, Change Orders, equipment manufacturer's changes, etc.) submitted to Owner.
    - f. The preliminary TAB report must be submitted to Engineer for review.
    - g. All equipment startup and testing reports must be submitted.
    - h. AIA G707-A "Consent of Surety to Reduction in or Partial Release of Retainage" submitted.
    - i. "Verification of Owner Training" (ZDS Form in Project Manual Specification Section 011001) must be submitted.
    - j. All equipment and systems' warranties as dictated by the Project scope shall be submitted.
    - k. Pre-Functional Testing (PFT) Forms must be completed, submitted, reviewed and accepted by the Engineer, or Cx Agent. (Applicable only on Commissioned Projects).
    - I. Occupancy Permits indicating approval by the Authority Having Jurisdiction (i.e.: West Virginia State Fire Marshal).
    - m. Removal of temporary facilities from site (ie: storage trailers, tools, etc.).
    - n. Cleaning and paint touchup completed.
    - o. Refer to Specification Sections 012900 "Payment Procedures" and 017700 "Closeout Procedures for additional information related to Substantial Completion requirements.
  - 2. Final Completion Requirements: (Contractor shall provide a letter signing off that all items below have been completed, final completion will not be approved until this has been received by the Engineer/Owner)
    - a. Substantial Completion Checklist has been completed, submitted and accepted.
    - b. Contractors written, signed and dated statement that all previous punch-list items have been completed.
    - c. O&M Manuals completed and submitted to Owner.
    - d. Preventive Maintenance (PM) Manuals (when applicable) completed and submitted to Owner.

- e. Final TAB Report completed and submitted to Owner.
- f. Contractor shall post framed instructions (Controls Diagrams, etc.) under glass or in approved laminated plastic and post where directed by Owner. The framed instructions will be as described in Operating and Maintenance manuals section of the specifications and/or Section 011001 General MEP/FP Requirements.
- g. Functional Performance Testing (FPT) Forms completed, reviewed and accepted by Engineer, Owner and Cx Agent (where applicable).
- h. Commissioning (Cx) Issues Log completed and submitted (where applicable).
- i. AIA Documents G706, G706A, G707 and G715 submitted.
  - 1) Certificate of Release from the State Department of Tax and Revenue.
  - 2) Owner has received and accepted equipment and systems' training videos.
  - 3) Final punch-list completed and signed by Contractor, Engineer and Owner.
  - 4) Contractor's letter stating a tentative date for the 11-month (or 23-month) walkthrough at the Project site.
- j. Contractor's letter of certification that all Work has been installed in accordance with the Construction Documents, applicable Codes/Regulations and the office of the West Virginia State Fire Marshal.
- k. Contractor's letter stating a proposed date for scheduling the fire damper inspection/testing committing to complete the task twelve (12) months after the Substantial Completion date in accordance with the Construction Documents and the AHJ.
- I. Refer to Owner provided Sections for "Payment Procedures", and additional "Closeout Procedures" for additional information related to Final Completion requirements.

**END OF SECTION 011001** 



# VERIFICATION OF OWNER TRAINING

Per the Contract Documents, the Contractor shall coordinate with the Owner a Complete System training session that includes devices "downstream" and other connected equipment.

Project Name:		
Architect/Engineer:		
Responsible Contractor(s):		
Date(s) of Training:		
Description of Training:		
Owner training was provided by the responsible co was performed in accordance with the contract do for the system(s) were provided to the owner for fi training:	cuments. All ow	vner's manuals and operating instruction
Name Representing	Name	Representing
The following have verified that the required train	ing has been sati	isfactory completed:
(Responsible Prime Contractor's signature)		(Date)
(Responsible Subcontractor's signature)		(Date)
(Project Architect / Engineer's signature)		(Date)
(Owner's Representative's signature)		(Date)

	Substantial Completion Requirements	Contractor Initial and Date
1.	Prior to Substantial Completion the Contractor shall provide to the Engineer a punch-list of items that need to be completed on the Project. List shall be submitted a minimum of seven (7) days prior to the Engineer's scheduled walkthrough.	
2.	O&M Manuals are required to be submitted to Engineer for review at 50% completion of the Project. Substantial Completion will not be established without Engineer's review and acceptance.	
3.	Preventive Maintenance (PM) Manuals (when applicable) shall be submitted to Engineer for review a minimum of two (2) weeks prior to the proposed Substantial Completion date.	
4.	Spare parts/Extra Materials shall be turned over to the Owner with a complete list of items provided. Owner's receipt and acceptance must be documented.	
5.	Record Documents (drawings, specifications' markups, Change Orders, equipment manufacturer's changes, etc.) submitted to Owner.	
6.	The preliminary TAB report must be submitted to Engineer for review.	
7.	All equipment startup and testing reports must be submitted.	
8.	AIA G707-A "Consent of Surety to Reduction in or Partial Release of Retainage" submitted.	
9.	"Verification of Owner Training" (ZDS Form in Project Manual) must be submitted.	
10	All equipment and systems' warranties as dictated by the Project scope shall be submitted.	
11.	Pre-Functional Testing (PFT) Forms must be completed, submitted, reviewed and accepted by the Engineer, or Cx Agent. (Applicable only on Commissioned Projects).	

12. Occupancy Permits indicating approval by the Authorit Jurisdiction (ie: West Virginia State Fire Marshal).		
13. Removal of temporary facilities from site (ie: storage tr	ailers, tools, etc.).	
14. Cleaning and paint touchup completed.		
Refer to Specification Sections 012900 "Payment Proce Procedures for additional information related to Substan		
Contractor Signature:	Date:	
Printed Name:	-	
Owner Signature:	Date:	
Printed Name:	-	

Final Completion Requirements	Contractor Initial and Date
Substantial Completion Checklist has been completed, submitted and accepted.	
Contractors written, signed and dated statement that all previous punch-list items have been completed.	
3. O&M Manuals completed and submitted to Owner.	
Preventive Maintenance (PM) Manuals (when applicable) completed and submitted to Owner.	
5. Final TAB Report completed and submitted to Owner.	
6. Contractor shall post framed instructions (Controls Diagrams, etc.) under glass or in approved laminated plastic and post where directed by Owner. The framed instructions will be as described in Operating and Maintenance manuals section of the specifications.	
7. Functional Performance Testing (FPT) Forms completed, reviewed and accepted by Engineer, Owner and Cx Agent (where applicable).	
Commissioning (Cx) Issues Log completed and submitted (where applicable).	
9. SBA funded Projects:  a. SBA Form 500 completed, signed and dated by Contractor, Engineer and Owner.	
10. Non-SBA funded Projects: a. AIA Documents G706, G706A, G707 and G715 submitted.	
b. Certificate of Release from the State Department of Tax and Revenue.	
c. Owner has received and accepted equipment and systems' training videos.	

d. Final punch-list completed and signed by Contract Owner.	tor, Engineer and
e. Contractor's letter stating a tentative date for the 1 month) walkthrough at the Project site.	1-month (or 23-
11. Contractor's letter of certification that all Work has bee accordance with the Construction Documents, applica Codes/Regulations and the office of the West Virginia Marshal.	able
12. Contractor's letter stating a proposed date for schedul damper inspection/testing committing to complete the months after the Substantial Completion date in accor Construction Documents and the AHJ.	task twelve (12)
Refer to Specification Sections 012900 "Payment Proce Procedures" for additional information related to Final C	
Contractor Signature:	Date:
Printed Name:	_
Owner Signature:	Date:
Printed Name:	_

### SECTION 011400 - WORK RESTRICTIONS

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. This section includes the following:
  - 1. Concurrent Occupancy.
  - 2. Use of Site and Premises.
  - 3. Security Procedures.
  - 4. Working Hours.
  - 5. Existing Utility Interruptions.
  - 6. Site Access.
  - 7. Operations Outside of Construction Limits.
  - 8. Site Protection.
  - 9. Fire Protection.
  - 10. Trash Disposal.
  - 11. Noise & Vibration Restrictions.
  - 12. Special Site Requirements.
  - 13. Burning and Welding Operations.
  - 14. Blasting.

## 1.3 CONCURRENT OCCUPANCY

- A. The State Capitol Buildings will remain occupied during the entire construction period. Contractor shall cooperate with GSD to minimize conflict and to perform work so as not to interfere with normal building operations to the greatest extent possible.
- B. Schedule work to accommodate building events and operations.
- C. Accessible ingress and egress for occupants, visitors, guests, staff, and support services must be continuously maintained, along with clear routes through the building if emergency personnel must access the building:

- 1. Keep all exits required by applicable code open during construction period.
- 2. Provide adequate protection for building occupants in accordance with OSHA and all applicable local, state, and federal codes and regulations.
- D. Do not obstruct roadways, sidewalks, or other public ways without permit.
- E. Proper operation of smoke evacuation controls, fire alarm, and personal safety systems must be maintained for the duration of the construction operations as approved by the GSD and State Fire Marshal.
- F. GSD will provide maintenance, security, and custodial services for occupied areas beyond the active construction zone during construction. The Contractor shall not interfere with such activities.
- G. Contractor shall coordinate with the GSD access to and security of existing mechanical/electrical equipment spaces.

### 1.4 USE OF SITE AND PREMISES

- A. General: Contractor shall have limited use of premises for construction operations, including use of Project site, during construction period as indicated in the Construction Documents. Contractor shall not disturb portions of the project site beyond areas in which the Work is indicated.
- B. The Capitol Building, including the construction limits, is a tobacco free environment. Tobacco use is only allowed in designated areas and at the approval of the GSD.
- C. Parking: Limited parking is available at the Project site. The following locations have been designated for Contractor parking as part of the project. Parking permits will be required for the duration of the project for vehicles parked in these locations. Coordination with the GSD will be required to obtain parking permits. Maps indicating exact parking locations and additional instructions are to be provided by GSD:
  - 1. Two (2) parking spots will be closed directly adjacent to the Contractor Laydown Area along California Avenue to allow access to the temporary roadway. Vehicles are not recommended to be parked here as they impede the temporary roadway, but these spaces could be used to temporarily drop-off and pick-up as needed.
  - 2. Additional parking is available at Laidley Field on Elizabeth Street in areas designated as "Capitol Complex Visitor Parking."
- D. Deliveries: Schedule deliveries to minimize use of driveways and entrances:
  - 1. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
  - 2. Schedule deliveries to minimize use of driveways and entrances by construction operations.
  - 3. Use Flag Person with proper personal protective equipment and traffic controls.
  - 4. Minimize traffic closures.
  - 5. Coordinate large deliveries with GSD and Division of Protective Services.

- 6. Contractor is responsible for receiving all deliveries; deliveries made to adjacent facilities or to the GSD will not be accepted.
- 7. Contractor use of public right-of-way shall conform to the requirements of local jurisdiction.

# E. Storage:

- 1. Contractor is solely responsible for the protection and storage of materials to prevent damage or theft.
- 2. Do not unreasonably encumber the site with materials or equipment.
- 3. Construction equipment, shoring, tools, etc., shall be stored only in areas designated as Contractor Work Areas. Move any stored products which will interfere with the operations of the State Capitol Complex.

### 1.5 SECURITY PROCEDURES

- A. All personnel that will be accessing the site during construction must obtain security clearance pursuant to West Virginia Code 15-2D-3(e), which requires that "any service providers whose employees are regularly employed on the grounds or in the building of the Capitol Complex or who have access to sensitive or critical information submit to a fingerprint based background inquiry through the state repository":
  - 1. Applications will be submitted to the Division of Protective Services.
  - 2. GSD will provide appropriate paperwork required to obtain security clearance.
- B. Key personnel from the Contractor will be required to obtain Access Cards that allow access to the building and to areas of the building not accessible to the public:
  - 1. Key personnel to receive access cards must be approved by the GSD.
  - 2. Security clearance must be complete in accordance with GSD protocol.
  - 3. Coordinate with the GSD to obtain access cards:
    - a. Key personnel must provide the following in order to obtain an access card:
      - 1) Name.
      - 2) Date of Birth.
      - 3) Driver's License Number.
      - 4) Contact/cell phone number.
    - b. Access cards, once approved, can be obtained from the Business Section of the General Services Division located on the 5th Floor of Building 4 located at 112 California Avenue
- C. The Contractor is required to provide the GSD a complete list of workers that will be on the job site fifteen (15) working days prior to the start of Work. Any changes in site personnel must be reported to the GSD in writing immediately. To be included on the list of workers are the names and badge numbers for each worker on site. Such information is required by the Division of Protective Services for safety reasons and in the event of an emergency.
- D. Picture ID badges provided by the Division of Protective Services must always be worn on outer garments above elbow level by each person:

- 1. Picture ID badges will be provided at no cost to the Contractor.
- 2. Any Contractor personnel not complying with this requirement will be denied access to the Capitol Building and may be escorted off premises by the Capitol security personnel.

## 1.6 WORKING HOURS

### A. On-Site Work Hours:

- 1. For spaces where repairs will cause little to no disruption to building occupants based on area of work or occupancy within space, work may be performed during normal business working hours of 7:00 AM to 5:00 PM, Monday through Friday, unless otherwise indicated.
- 2. For spaces where repairs will displace building occupants or cause significant disruption to building occupants, night work will likely be necessary and should be coordinated with the GSD:
  - a. Night Work: Night work is considered any work outside of normal working hours during the typical work week.
- 3. Weekend Hours: Weekend work shall be coordinated with the GSD.
- B. Deliveries: Limit deliveries to normal business hours of 7:00 AM to 7:00 PM, Monday through Friday, unless otherwise indicated.

### 1.7 EXISTING UTILITY INTERRUPTIONS

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by building occupants or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - The Contractor shall include planned disruptions to the building utilities in the agendas for project meetings, but in no case shall the Contractor proceed with any work that could disrupt services to the building without a fourteen (14) calendar day written notice to the GSD and a written agreement by the GSD to the proposed outage or disruption period.
  - 2. Do not proceed with utility interruptions without GSD's written permission.

### 1.8 SITE ACCESS

- A. All access to work areas shall be from the designated construction service areas. Construction signs, traffic control signs, and safety signs shall be prepared prior to work proceeding.
- B. Workers shall always uphold construction safety regulations and guidelines in accordance with federal, state, and local jurisdictions.

- C. At the completion of all work, Contractor to verify all laydown areas and access routes are free of debris and damage and are returned to the GSD in their preconstruction condition:
  - 1. All lawn locations are to be restored in accordance with lawn restoration requirements outlined on the Drawings and required to meet GSD requirements.
  - 2. All sidewalks and curbs are to be restored if damaged as part of construction.
- D. Access Provisions: Designated Contractor routes through the building to the interior of any work area shall be coordinated with the GSD but are generally described as follows:
  - 1. Access to the building should be through the south-east entrance as indicated on the Drawings along California Avenue. Access cards must be used to access the building through this entrance:
    - a. Access to the building can also be through the public entrances where a security screening is required. Access cards are not required for access through these entrances, but these entrances are only available for limited times during the day.
  - 2. Access through the loading dock must be coordinated with the Division of Protection Services. Contractor to alert Division of Protective Services no less than forty-eight (48) hours in advance when access through the loading dock is required.
  - 3. Access between the Basement Level and Second Floor Level of the Main Building shall be through the service elevator as indicated on the Drawings.
  - 4. Access to the East and West Wings of the Capitol shall be from the Ground Floor of the Main Capitol Building.
  - Access to individual rooms must be coordinated with the GSD and Division of Protective Services. In some instances, access to individual rooms may be provided to Key Personnel via access cards; however, in other cases access may need to be provided by the Division of Protective Services.

# 1.9 OPERATIONS OUTSIDE CONSTRUCTION LIMITS

- A. Construction fencing and lay down area limits are indicated on the Drawings:
  - The Contractor shall comply with designated travel paths, staging areas, dumpster locations, and other restricted items as coordinated with, and directed by, the Owner.
- B. Use of certain passageways and other areas, outside of defined limits of construction, will be granted on an as needed basis. Requests must be approved by the GSD in writing prior to access being granted.

# 1.10 SITE PROTECTION

A. See Section 015000 "Temporary Facilities and Controls" for additional information on site protection.

- B. Temporary construction barriers, pedestrian protection, traffic control measure, and all necessary temporary facilities and protection barriers shall be constructed or installed in accordance with the 2015 International Building Code (IBC); Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD 2009) Chapter 6; and ANSI A10.34 (2001, R2012) "Protection of the Public On or Adjacent to Construction Sites American National Standard for Construction and Demolition Operations;" the most stringent requirement shall govern under circumstances of overlapping standard requirements.
- C. No work shall commence until all temporary controls related to the pedestrian protection, egress, and worker access are in place:
  - 1. Where necessary, inspections are to be performed by the GSD and State Fire Marshall prior to the start of work. Contractor shall be responsible for coordinating inspections with construction schedule and providing inspector access to each location.
- D. The Contractor shall protect lawn and landscaped areas, including prohibiting traffic through such areas except along the temporary access road and the designated laydown area.
- E. The Contractor shall install protection as specified, shown in the Drawings and required for areas adjacent to construction and at areas where other building components could be damaged by the work.
- F. The Contractor shall protect the interior of the building from damage when transporting construction materials/debris through the building. All damage to the interior of the building must be repaired to the satisfaction of the GSD and Engineer at no additional cost to the GSD.

### 1.11 FIRE PROTECTION

- A. Provide continuous unobstructed access to all fire water supply valves and fire access boxes.
- B. Provide and maintain hand fire extinguishers suitable for fire hazards involved at convenient accessible locations during construction. The Contractor shall keep fire extinguishers as needed in work areas and around stored flammable materials. The type of extinguisher shall be appropriate for the service and in enough numbers for the workers to control fires accidentally caused by the Work.
- C. Avoid accumulations of combustible forms, form lumber, and debris within construction site.
- D. A fire extinguisher shall be located by all gasoline or diesel-powered equipment.
- E. Handling of Flammable Liquids:
  - 1. Store flammable or volatile liquids approved containers in open air or in small detached structures or trailers.

- 2. Closely supervise storage of paint materials and other combustible finishing and cleaning products.
- 3. Do not store oily rags in closets or other light spaces.
- 4. Prohibit smoking in vicinity of hazardous operations.
- F. Smoke detectors and carbon monoxide detectors are to remain operable and unobstructed.

## 1.12 TRASH DISPOSAL

- A. See Section 017419 "Construction Waste Management and Disposal" for additional requirements for cleaning and waste management, to include trash disposal.
- B. Keep building and project site free from accumulations of trash.
- C. Remove cartons, crates, wrappings, lunch trash and other trash daily.
- D. Do not burn paper, trash or other material on site.
- E. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary sewers.

### 1.13 NOISE & VIBRATION RESTRICTIONS

- A. The GSD may request that a demonstration be conducted, using the actual project equipment, to determine whether site restrictions are required.
- B. Contractor personnel are not to engage in conversation with anyone outside of the Construction Team regarding noise or vibration complaints. All complaints shall be directed to the GSD Project Manager.
- C. Work hours may be limited throughout the contract time as a result of noise conflicts with an event or activity within the building. Notice will be given prior to date of event for any schedule needs.
- D. Contractor shall develop and maintain a noise-abatement program and enforce strict discipline over all personnel to keep noise to a minimum, especially while designated sensitive spaces are occupied.
- E. Contractor shall execute Work by methods and use of equipment which will reduce excess noise and shall employ construction methods and equipment which produce the minimum amount of noise and handle vehicular traffic.

### 1.14 SPECIAL SITE REQUIREMENTS

A. During the project, "visitors," interested staff, etc. may attempt to solicit information from Contractors and Subcontractors. The Contractor shall have procedures in place that deters all workers onsite from giving any information to passers-by. All inquiries should

be directed to the GSD Project Manager. The Contractor shall have a confidentiality policy in place that discourages all workers from taking any photo or video within the construction area for their own personal use. Additionally, the Contractor should have procedures in place that further discourages the posting of any media to any social media sites, blogs, instant messengers, or other forms of media:

- 1. All media requests shall be directed to the GSD's Project Manager.
- B. Pre-document site conditions prior to work. Video or photos are acceptable.
- C. Designate a safety officer who will coordinate and run routine safety meetings.
- D. All visitors within the Project site shall sign in at the field office trailer or other designated site.
- E. Use of alcohol, illegal substances, and possession of firearms are prohibited.

## 1.15 BURNING AND WELDING OPERATIONS

A. The Contractor shall provide the GSD five (5) working days' advance notice for all burning and welding operations. A fire watch shall be maintained during burning and welding operations per order of the state Fire Marshall Office.

## 1.16 BLASTING

A. Blasting is strictly prohibited on Capitol Grounds.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 011400

### SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

### B. Related Sections:

1. Division 1 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

### 1.3 MINOR CHANGES IN THE WORK

A. Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

### 1.4 PROPOSAL REQUESTS

- A. Contract Modifications: All requests or assertions related to changes in the Contract Sum and/or Contract Time, including Owner proposal requests, Contractor change order requests, Claims, Contractor cost proposals, Change Orders or Construction Change Directives.
- B. Contract Modifications Costs: Submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the contract modification change.
  - 1. Include a list of quantities and costs of products required or eliminated, and unit costs (if applicable), with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

- 2. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- 3. Include costs of labor directly attributable to the change.
- 4. Include costs of supervision directly attributable to the change:
  - a. "Supervision directly attributable to the change" means only those applicable costs related to assigning dedicated supervisory personnel, such as a foreman, to specifically and exclusively oversee the construction of the change. Such personnel cannot include general Project field supervision, whose time is apportioned to the entire project and whose additional costs to the contract modification amount are covered in the Overhead allowance specified in Paragraph 1.5.A.1 of this Section.
- 5. Schedule Impact: If the change will affect the Project Schedule's critical path, include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- C. Owner-Initiated Proposal Requests: The Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications:
  - 1. Proposal Requests issued by Engineer are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed the proposed change unless expressly stated in writing as part of the proposal request.
  - 2. Unless approved otherwise by the Engineer, after receipt of request, submit proposed time and costs for the requested change(s) within the time limit(s) established.
  - 3. Contractor Cost Proposals shall be submitted to the Engineer for review within 7 days of the issuance of the Proposal Request utilizing the Contractor Cost Proposal Form, as outlined in Paragraph 1.6.B of this section.
  - 4. Contractor-Initiated Requests: If latent unforeseen or other excused and compensable conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer:
    - a. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
    - b. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
    - c. For Contractor-Initiated Requests, notification of potential adjustment of Contract Sum shall be provided to the Engineer immediately, and no later than 7 days following the event or discovery of the condition. A Cost Proposal for the work shall also be submitted within 7 days following notification to the Engineer. Should the Contractor need additional time for the Cost Proposal, it must be granted by the Engineer ahead of the 7-day deadline, otherwise the Contractor's Cost Proposal may be rejected in its entirety due to untimeliness.

- d. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
- e. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
- f. Include costs of labor directly attributable to the change.
- g. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- 5. Contractor Cost Proposal Form: Reference herein paragraph 1.6.B:
  - a. In addition to submitting the Contractor and Sub-Contractor Cost Proposal (if necessary) Form with each proposed change, sufficient back-up documentation shall be provided in accordance with the Contract Documents including, but not limited to: Material and/or equipment invoices, breaking out quantities, cost per unit, and applicable taxes, and additional information as may be requested by the Engineer. Any Cost Proposal submitted without proper back-up documentation shall be returned to the Contractor for revision within 7 days to be resubmitted to the Engineer for revaluation.
  - b. For changes that require additional labor, man-power shall be represented on the Cost Proposal Form indicating the classification of the labor (i.e. journeyman, apprentice, laborer, etc.), quantity of that classification and applicable man-hours per unit (i.e. 2 Journeyman, 12 direct labor hours per unit, etc.).
  - c. Utilize rows on the Cost Proposal Form under the description column to separately distinguish labor, material and equipment as to not quantify costs incorrectly (e.g. Item No. 1.01 Journeyman Labor, Item No. 1.02 Sch. 40 PVC Pipe, Item No. 1.03 Backhoe, etc.)
  - d. Material, Labor and Equipment that is not directly owned by the Prime Contractor shall be considered a Subcontractor Cost, and shall require the submission of the Subcontractor SC-01 form as back-up, and these costs shall be placed in the appropriate column and the applicable mark-up as stipulated by the Contract Documents shall be due to the Prime Contractor.

# 1.5 CHANGE ORDER PROCEDURES

- A. On Owner's acceptance of a Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor on AIA Document G701. Owner will submit completed AIA G701 to the WV State Purchasing Division to request formal approval of the Change Order; multiple proposal requests may be consolidated into a single AIA G701 form. Once the Change Order has been approved and processed by the WV State Purchasing Division, the Change Order shall be added to the Application for Payment. No payments can be made towards a Change Order which increases Contract Sum until such time that the Change Order has been fully processed and approved by the State Purchasing Division.
  - 1. All cost proposals for Prime Contractor must be submitted on the attached form "Attachment GC-1", respectively. Subcontractors breakdown of costs are to be submitted on the sub-contractor's company letterhead with labor, equipment,

- material, and miscellaneous cost broken out as deemed sufficient by the Engineer. Cost proposals will not be reviewed if the Prime Contractor and/or Subcontractor fails to provide the respective cost proposal forms in supplement.
- 2. Contractor's and their subcontractors shall submit to the Engineer, prior to review of the Contractor's and any associated subcontractor's first change proposal, a percentage breakdown of the company's labor burden as requested on the Contractor and Sub-Contractor Cost Proposal Forms, Attachment GC-1 and Attachment SC-01. If fringes are included as part of the base rate under column G of the Direct Labor on the Cost Proposal Form, these same fringes shall not be excluded from the labor burden percentage. Certified Payrolls will be reviewed as necessary by the Engineer to verify the base rate, fringe benefits and labor burden submitted on the Contractor Cost Proposal Form.

### 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order, upon mutual agreement of all terms by the Owner, Engineer and Contractor:
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
  - 2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive:
    - a. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

## 1.7 ASBESTOS ABATEMENT REQUIREMENTS

A. Asbestos abatement, if required, will be separately contracted by the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

# GC-1

# CONTRACTOR COST PROPOSAL SUMMARY SHEET

Project: Contractor: Proposal Number: Proposal Description:

				CON	TRACTOR I	DIRECT COS	STS				
	Scope Descriptio	n			Direct	Labor		Direct	Material	Direct Equipment	
Item No.	Description	Quantity	Qty Units	Direct Labor Hours Per Unit	Total Direct Labor Hours	Hourly Wage Rate, Excl. Taxes & Ins.	Total Labor Cost	Material Cost Per Unit	Total Material Cost	Equipment Cost Per Unit	Total Equipment Cost
Α	В	С	D	E	F = C x E	G	H = F x G	I	J = C x I	K	L = C x K
1.01					0.00		\$0.00		\$0.00		\$0.00
1.02					0.00		\$0.00		\$0.00		\$0.00
1.03					0.00		\$0.00		\$0.00		\$0.00
1.04					0.00		\$0.00		\$0.00		\$0.00
1.05					0.00		\$0.00		\$0.00		\$0.00
1.06					0.00		\$0.00		\$0.00		\$0.00
1.07					0.00		\$0.00		\$0.00		\$0.00
1.08					0.00		\$0.00		\$0.00		\$0.00
1.09	Subtotal from Estimate Continuatio	n Sheets					\$0.00		\$0.00		\$0.00
1.97	Subtotal (S/T) Direct Costs:					Subtotal Labor	\$0.00	Subtotal Mat'l	\$0.00	Subtotal Equip.	\$0.00
1.98	Taxes/Insurance:			Labor Burden		% of Item 1.97H =	\$0.00	Sales Tax	\$0.00	Sales Tax	\$0.00
1.99	Total Direct Costs					Total Labor	\$0.00	Total Mat'l	\$0.00	Total Equip.	\$0.00

	SUBCONTRACT COSTS								
Item	Subcontractor Name	Total							
No.	(List totals from attached SC-1 forms)	Cost							
Α	В	С							
2.01									
2.02									
2.03									
2.04									
2.05									
2.06									
2.07									
2.08									
2.09									
2.10									
2.99	Total Subcontract Costs	\$0.00							

	SUMMARY							
Item No.	Description		Total Cost					
3.01	Total Direct Labor Cost	Item 1.99H	\$0.00					
3.02	Total Direct Material Cost	Item 1.99J	\$0.00					
3.03	Total Equipment Cost	Item 1.99L	\$0.00					
3.04	Subtotal	3.01+3.02+3.03	\$0.00					
3.05	Overhead and Profit (%)	%	\$0.00					
3.06	Subtotal	3.04+3.05	\$0.00					
3.07	Subcontractor Cost	Item 2.99	\$0.00					
3.08	Markup on Subcontractors (%)	%	\$0.00					
3.09	Subtotal	3.06+3.07+3.08	\$0.00					
3.10	Additional Bond Cost	%	\$0.00					
3.11	B&O Tax	%	\$0.00					
3.99	Total Proposal Cost	(3.09+3.10+3.11)	\$0.00					

	Submitted By
Name:	
Signature:	
Title:	
Date:	

# SUBCONTRACTOR COST PROPOSAL Summary Sheet

Project: Contractor: **Sub-Contractor:** Proposal Number: Proposal Description:

				SUB	CONTRACT	OR DIRECT CO	STS				
	Scope Description Direct Labor			Direct	Material	Direct Ec	uipment				
Item No.	Description	Quantity	Qty Units	Direct Labor Hours Per Unit	Total Direct Labor Labor Hours	Hourly Wage Rate, Excl. Taxes & Ins.	Total Labor Cost	Material Cost Per Unit	Total Material Cost	Equipment Cost Per Unit	Total Equipment Cost
Α	В	С	D	E	F = C x E	G	H = F x G	1	J = C x I	κ	L = C x K
1.01					0.00		\$0.00		\$0.00		\$0.00
1.02					0.00		\$0.00		\$0.00		\$0.00
1.03					0.00		\$0.00		\$0.00		\$0.00
1.04					0.00		\$0.00		\$0.00		\$0.00
1.05					0.00		\$0.00		\$0.00		\$0.00
1.06					0.00		\$0.00		\$0.00		\$0.00
1.07					0.00		\$0.00		\$0.00		\$0.00
1.08					0.00		\$0.00		\$0.00		\$0.00
1.09	Subtotal from Estimate Continuation Sh	eets					\$0.00		\$0.00		\$0.00
1.97	Subtotal (S/T) Direct Costs:	_		<u> </u>	_	Subtotal Labor	\$0.00	Subtotal Mat'l	\$0.00	Subtotal Equip.	\$0.00
1.98	Taxes/Insurance:			Labor Burden		% of Item 1.97H =	\$0.00	Sales Tax	\$0.00	Sales Tax	\$0.00
1.99	Total Direct Costs					Total Labor	\$0.00	Total Mat'l	\$0.00	Total Equip.	\$0.00

	SUB-SUBCONTRACT COSTS								
Item	Sub-Subcontractor Name	Total							
No.	(List totals from Sub-Subcontractors)	Cost							
Α	В	С							
2.01									
2.02									
2.03									
2.04									
2.05									
2.06									
2.07									
2.08									
2.09									
2.99	Total Sub-Subcontract Costs	\$0.00							

	SUMMARY		
Item No.	Description		Total Cost
3.01	Total Direct Labor Cost	Item 1.99H	\$0.00
3.02	Total Direct Material Cost	Item 1.99J	\$0.00
3.03	Total Equipment Cost	Item 1.99L	\$0.00
3.04	Subtotal	3.01+3.02+3.03	\$0.00
3.05	Overhead and Profit (%)	%	\$0.00
3.06	Subtotal	3.04+3.05	\$0.00
3.07	Sub-Subcontractor Costs	Item 2.99	\$0.00
3.08	Markup on Sub-Subcontractors (%)	%	\$0.00
3.09	Subtotal	3.06+3.07+3.08	\$0.00
3.10	B&O Tax	%	\$0.00
3.99	Total Proposal Cost (to GC-01)	3.09+3.10	\$0.00

	Submitted By
Name:	
Signature:	
Title:	
•	
Date:	

### SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

### B. Related Sections:

- 1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
- 2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's construction schedule.
- 3. Division 01 Section "Submittal Procedures" for administrative requirements governing the preparation and submission of a submittal schedule.

# 1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule:
  - 1. Correlate line items in the schedule of values with other required administrative forms and schedules, including:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - Items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Engineer at earliest possible date but no later than 14 days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use the Project Manual table of contents, including Division 1 General Requirements, as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section:
  - 1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Engineer.
    - c. Engineer's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Arrange schedule of values consistent with format of AIA Document G703:
    - a. Related Specification Section or Division.
    - b. Description of the Work.
    - c. Change Orders (numbers) that affect value.
    - d. Dollar value of the following, as a percentage of the Contract Sum to nearest 1%, adjusted to total 100%:
      - 1) Provide schedule breakdown for each item into labor and materials.
  - 3. Provide breakdown of Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual Table of Contents. Provide multiple line items for principal subcontract amounts, where appropriate.
  - 4. 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. If required, include evidence of insurance.
  - 5. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- C. Alternates: Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- D. Allowances: Provide separate line item in Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of unit cost, multiplied by measured quantity. Use information indicated in Contract Documents to determine quantities.
- E. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item:
  - 1. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
  - 2. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner:
  - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- 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:
  - 1. Submit draft copy of Application for Payment 14 days prior to due date for review by Engineer.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer 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 are made.
  - 2. Include amounts for work completed following previous Application for Payment. 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.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site:
  - 1. Provide certificate of insurance for stored materials.
  - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment:
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
- G. When an application shows completion of an item, submit conditional final or full waivers.
- H. Owner reserves right to designate which entities involved in the Work must submit waivers.

- I. 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 that is lawfully entitled to a lien.
- J. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- K. 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.
- L. Schedule of values.
- M. Contractor's construction schedule (preliminary if not final).
- N. Products list (preliminary if not final).
- O. Schedule of unit prices.
- P. Submittal schedule (preliminary if not final).
- Q. List of Contractor's staff assignments.
- R. Copies of building permits.
- S. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
- T. Report of preconstruction conference.
- U. Certificates of insurance and insurance policies.
- V. Performance and payment bonds.
- W. Data needed to acquire Owner's insurance.
- X. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, apply for Payment showing 100% 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 Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
  - 3. As a prerequisite to Substantial Completion and prior to submitting the Application for Payment at Substantial Completion, Contractor to provide evidence of having completed all administrative actions and submittals as set forth in Division 1 Section "Closeout Procedures." As submitted to the Engineer and Owner and approved by the Engineer, the closeout submittals shall include, but are not limited to the following:

- a. Provide Contractor's list of items to be completed or corrected.
- b. Provide complete sets of warranty, bonds, and maintenance agreements.
- c. Provide copies of occupancy permits or similar approval certifications by the authority having jurisdiction, including but not limited to, occupancy permit issued by the State of West Virginia Office of the State Fire Marshal.
- d. Provide copies of Consent of Surety for Reduction in or Partial Release of Retainage letter advising Owner on coordination of shifting insurance coverages including proof of extended insurance coverages as required.
- e. Provide copies of test and air balance reports, meter readings, maintenance instructions, startup reports, or similar information necessary for the Owner's occupancy and use of the facilities.
- f. Provide certification of final change-over of locks and transmittal of keys to Owner.
- Y. Final Payment Application: Submit to the Engineer and Owner and approved by the Engineer 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.
- Z. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
- AA. Updated final statement, accounting for final changes to the Contract Sum.
- BB. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
- CC. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
- DD. AIA Document G707, "Consent of Surety to Final Payment."
- EE. Evidence that claims have been settled.
- FF. 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.
- GG. Certified copy of Engineer's Substantial Completion report stating that each item has been completed, corrected, or otherwise resolved to the Owner's satisfaction.
- HH. Evidence of final cleaning completion.
- II. Completed warranty manuals, operations and maintenance manuals, and record submittals.
- JJ. Comprehensive list of sub-contractors, suppliers, and warranty contact personnel.
- KK. One complete Set of PDF format and hard copy plotted record drawings clearly marked to show installation of work where the actual installation varies substantially from the work as originally shown.

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LL. Certificate of Release from the Department of Tax and Revenue stating all appropriate taxes have been paid.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

### SECTION 013000 - ADMINISTRATIVE REQUIREMENTS

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

## 1.2 PROJECT MANAGEMENT AND COORDINATION:

- A. Verify layout information shown on Drawings, in relation to property survey and existing benchmarks, before laying out the Work.
- B. Coordinate construction to ensure efficient and orderly execution of each part of the Work.
- C. Progress meetings will be held at Project site every two weeks. Meeting dates will be coordinated with Owner and Engineer and Contractor shall notify Owner and Engineer of meeting dates. Each subcontractor or other entity concerned with current progress or involved with planning or coordination of future activities, shall attend:
  - 1. Within five (5) days after meeting date distribute minutes to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- D. Personnel: In addition to a full-time on-site Project General Superintendent experienced in his specific role in projects of this size and nature, provide other administrative and supervisory personnel each fully experienced in their specific roles in projects of this size and nature as required for performance of the work. Also, provide specific-coordinating personnel as specified herein:
  - Submittal of Staff Names and Duties: at the Pre-Construction Conference, submit a listing of Contractor's staff names and duties to the Owner and Engineer. List to include superintendent, and consultants, naming persons and listing their addresses, office and mobile telephone numbers, and e-mail address. Provide names and addresses of individuals assigned as standbys in the absence of individuals assigned to the project:
    - a. Post copies of this list in Project Meeting Room, in temporary field office, and by each temporary telephone.

### 1.3 CONSTRUCTION SCHEDULE:

- A. Prepare a horizontal bar-chart construction schedule. Provide a separate time bar for each activity and a vertical line to identify the first workday of each week. Use same breakdown of Work indicated in the Schedule of Values:
  - 1. Draft of schedule required at Pre-Construction Conference; and finalized within five (5) working days thereafter.
  - 2. Coordinate each element with other activities. Show each activity in proper sequence. Indicate sequences necessary for completion of related Work.
  - 3. Indicate Substantial Completion and allow time for Engineer's procedures necessary for certifying Substantial Completion.
  - 4. Schedule Distribution: Distribute copies to Owner, Engineer, subcontractors, and parties required to comply with dates.
  - 5. Updating: Revise the schedule after each meeting or activity where revisions have been made. Distribute revised copies to Owner, Engineer, subcontractors, and parties required to comply with dates.

### 1.4 SUBMITTAL PROCEDURES:

A. Refer to Section 013300 for submittal procedures.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

## 3.1 GENERAL INSTALLATION PROVISIONS:

- A. Installer's Inspection of Conditions: Require the Installer of each major unit of work to inspect the substrate to receive work and conditions under which the work is to be performed. The Installer shall report all unsatisfactory conditions in writing to the Contractor. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- B. Manufacturer's instructions: Comply with manufacturer's applicable instructions and recommendations for installation to the extent that these instructions and recommendations are more explicit or more stringent than requirements indicated in the Contract Documents:
  - 1. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
  - 2. Provide attachments and connection devices, and methods necessary for securing work. Secure work true to line and level, and within recognized industry tolerances. Allow for expansion and building movement.

- C. Visual Effects: Provide uniform joint width in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable visual effect choices to the Engineer for final decision:
  - 1. Recheck measurements and dimensions of the work, as an integral step of starting each installation.
  - 2. Install each component during weather conditions and project status, which will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
  - 3. Coordinate temporary enclosure of the work with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.
- D. Mounting Heights: Where mounting heights are not indicated, mount individual components to meet the requirements of the Americans with Disabilities Act Accessibility Guidelines where required or at industry recognized standard-mounting heights for the application indicated. Refer questionable mounting height choices to the Engineer for final decision.
- E. Contract Drawing Clarifications: The drawings are diagrammatic and are a graphic representation of the contract requirements. No Subcontractor or Contractor shall take advantage of conflict or error between drawings and specifications. Should this condition occur, the Subcontractor or Contractor shall request a clarification from the Engineer. If there is insufficient time to issue an addendum for the clarification, the Contractor shall figure on the most expensive of the items in conflict. No measurements shall be scaled from the drawings and used as definite dimensions or layout or fitting work in place without verification with the Engineer.
- F. Measurements: All dimensions shown shall be field verified by the Contractor and be actual measurements of the existing conditions. Any discrepancies between the drawings and specifications, and the existing conditions shall be referred to the Engineer in writing for adjustment before any work affected thereby has been performed:
  - 1. Before ordering any material or doing any work, Contractor shall take all necessary measurements at the building location and shall be responsible for the correctness of same. No extra charge or compensation will be allowed on account of difference between actual dimensions and the dimensions indicated on the drawings.
- G. Existing Utilities: Existing utilities, the nature and location of those which are approximately known, are indicated on the drawings. All Contractors and Subcontractors shall take all precautions not to disturb these, or any other lines, that may be encountered (especially those underground) until arrangements for re-routing these services are completed.
- H. New Work: Unless otherwise noted on drawings or specified, new work in extension of existing conditions shall correspond in all respects to similar existing conditions in material, workmanship and finish.
- I. Existing Work: Existing work shall be cut, drilled, altered, removed or temporarily removed and replaced for performance of work under the contract. Work replaced shall match similar existing work in materials and finish. Structural members shall not be cut or altered, except as shown, without authorization of the Engineer. Work remaining in

place, damaged or defaced during this contract shall be restored to the condition at time of award of contract. Each Subcontractor is responsible for his own related work as called for and/or required in this paragraph.

- J. Erection Procedure and Safety: The structure is designed to be self-supporting and stable after the work is fully complete. It is solely the Contractor's responsibility to determine erection procedures and sequence to ensure the safety of the building and its component parts during erection. This includes the addition of whatever temporary bracing, guys and/or tie-downs as might be necessary. Such material shall remain the property of the Contractor after completion of the project.
- K. Manufacturer's Directions: All manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned, and put into operation as directed by manufacturers for a long and useful life. Manufacturer in providing such is also to certify it complies with all applicable codes and regulations; (or) notify Engineer in writing of necessary adjustments for compliance ten (10) days prior to bid. Any necessary adjustments will be made by Addendum. Do not proceed until manufacturer and installer certifies compliance with applicable regulations. The Contractor shall be responsible for obtaining such instruction from the suppliers.
- L. Workmanship: All labor shall be performed in the best and most workmanlike manner by mechanics skilled in their respective trades. The standards of the work required throughout shall be of such grade as will bring first class results. Mechanics whose work is unsatisfactory to the Owner, Engineer, or are considered by the Engineer to be unskilled or otherwise objectionable, shall be instantly dismissed from the work upon notice from the Engineer.
- M. Code Applications: All standards and specifications promulgated by the Occupational Safety and Health Administration of the US Department of Labor, all applicable state and federal laws, municipal ordinances and codes, and rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to the contract the same as though herein written out in full. All material suppliers, contractors, installers, etc. shall certify prior to any work that their materials use and purpose in this structure passes and is approved by all applicable regulations.

END OF SECTION 013000

### SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General project coordination procedures.
  - 2. Administrative and supervisory personnel.
  - 3. Coordination drawings.
  - 4. Requests for Information (RFIs).
  - 5. Project meetings.

## B. Related Sections:

- 1. Division 1 Section "Summary of Work" for overview of project phasing of work.
- 2. Division 1 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
- 3. Division 1 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
- 4. Division 1 Section "Closeout Procedures" for coordinating closeout of the Contract.

## 1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation:
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

- 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
- 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Subcontractor Coordination: Each subcontractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each subcontractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.
- C. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings:
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Pre-installation conferences.
  - 7. Project closeout activities.
  - Startup and adjustment of systems.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out 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. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

# 1.4 COORDINATION DRAWINGS/MODELS

- A. Coordination Drawings/Models General: Prepare 2D and 3D coordination drawings in accordance with requirements, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
- B. Coordination drawing files are to be submitted to the Engineer from Contractor for construction coordination when requested by the Engineer for model clash detection. Coordination Drawings created in 2D must be converted into 3D for use when requested

by the Engineer. Hard copy coordination drawings will be required for submittal to the Engineer, which are generated from the 3D Building Information Model or Engineer approved model used to create said coordination drawings:

- 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
  - Use applicable Drawings as a basis for preparation of coordination drawings.
     Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
  - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
  - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
  - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
  - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
  - f. Indicate required installation sequences.
  - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be a conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
  - h. In the case of underground utilities and structures, provide accurate measurements from fixed points, depth of lines, locations of change of directions of lines, location of pull boxes. Where site utilities are terminated for future hookup by the building trades contractors cap lines, identify location of termination with a stake or PVC pipe extending a minimum of 4' above finish grade and flag stake or pipe with vinyl colored tape. On the pipe or stake include the following information type of line or pipe (gas, water, sanitary, storm, elec., TV, Tele, etc.) depth to pipe and size of pipe or conduit.
- C. Coordination Drawing: Contractors will be required to submit their coordination drawing electronic files to Engineer.
- D. Coordination Digital Data Files: Contractors may create 3D shop drawings or coordination drawings in any file type that they choose, given that the file is converted into one of the following file formats before submission to the Engineer: RVT (Revit), NWD (Navisworks), NWF (Navisworks), DXF (CAD), or DWG (3D CAD). Other file formats may be considered by the Engineer but must be submitted in the form of a written question prior to the deadline for questions during the bidding phase.
- E. Digital Model Release Form: Contractors are required to submit this form to obtain any files or models from the Engineer for reference only in preparing coordination drawings or coordination between building systems and elements:

- 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
  - Use applicable Drawings as a basis for preparation of coordination drawings.
     Prepare details, roof plan with exact existing roof drain locations, tapered insulation layout.
  - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
  - c. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be a conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

### 1.5 KEY PERSONNEL

A. Key Personnel Names: at Pre-Construction Conference, submit a list of key personnel names and assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

## 1.6 REQUESTS FOR INFORMATION (RFIs)

- A. RFI General: Request from Owner, Engineer, or Contractor seeking information from each other during construction.
- B. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified:
  - 1. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
- C. Transmission: Transmit each RFI to the Engineer electronically, via email.
- D. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  - 1. Project name.
  - 2. Project number.
  - 3. Date.
  - Name of Contractor.
  - 5. Name of Engineer.
  - 6. RFI number, numbered sequentially.
  - 7. RFI subject
  - 8. Specification Section number and title and related paragraphs, as appropriate.

- 9. Drawing number and detail references, as appropriate.
- 10. Field dimensions and conditions, as appropriate.
- 11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
- 12. Contractor's signature.
- 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation:
  - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- E. RFI Content: Include detailed, legible description of item needing information or interpretation on Contractor's Standard Form.
- F. Engineer's Action: Engineer will review each RFI; Engineer will subsequently determine action required and respond. Indicate specific date of requested response deadline, allowing for a realistic amount of time for the Engineer to formulate an appropriate response to each RFI, depending upon the nature and scope of the request. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day:
  - 1. The following RFIs will be returned without action:
    - a. Requests for status of review or approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for coordination information already indicated in the Contract Documents, except for a brief response, noting where to locate such information.
    - d. Requests for adjustments in the Contract Time or the Contract Sum.
    - e. Requests for interpretation of Architect's actions on submittals.
    - f. Incomplete RFIs or inaccurately prepared RFIs.
  - 2. Engineer's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  - 3. Engineer's action on RFIs that may result in a change to the Contract Time, or the Contract Sum may be eligible for Contractor to submit Change Proposal per Division 01 Section "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants a change in the Contract Time or the Contract Sum, he shall notify the Engineer in writing within 7 days of receipt of the RFI response. The Contractor agrees that his failure to provide a cost or schedule impact, within the specified 7-day period, waives any future claim for a cost or schedule change based on the RFI in question.

### 1.7 PROJECT MEETINGS

A. General: Prime Contractor shall schedule and conduct meetings and conferences at Project site, unless otherwise indicated. Electronic meetings shall be conducted by Contractor at the request of the Engineer for project meetings for Engineer's participation remotely:

- 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
- 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
- 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within five (5) days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a Pre-Construction Conference at a time convenient to the Owner and Engineer, but no later than five (5) business days after Owner notification that Contract has been awarded:
  - 1. Conduct the conference to review responsibilities and personnel assignments.
  - Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - I. Preparation of record documents.
    - m. Use of the premises.
    - n. Work restrictions.
    - o. Working hours.
    - p. Owner's occupancy requirements.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.
    - s. Procedures for disruptions and shutdowns.
    - t. Construction waste management and recycling.
    - u. Parking availability.
    - v. Office, work, and storage areas.
    - w. Equipment deliveries and priorities.
    - x. First aid.
    - y. Security.
    - z. Progress cleaning.
  - 4. Prime Contractor will record and distribute meeting minutes.
- C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction:

- Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates. Electronic meetings shall be conducted by Contractor at the request of the Engineer for conferences for Engineer's participation remotely.
- 2. Agenda: Review progress of other construction activities and preparations for the specific activity under consideration, including requirements for the following:
  - a. Contract Documents.
  - b. Options.
  - c. Related RFIs.
  - d. Related Change Orders.
  - e. Purchases.
  - f. Deliveries storage and protection of materials.
  - g. Submittals.
  - h. Review of mockups.
  - i. Possible conflicts.
  - j. Compatibility problems.
  - k. Time schedules.
  - I. Weather limitations.
  - m. Manufacturer's written installation requirements and recommendations.
  - n. Warranty requirements.
  - o. Compatibility of materials.
  - p. Acceptability of substrates.
  - q. Temporary facilities and controls.
  - r. Space and access limitations.
  - s. Regulations of authorities having jurisdiction.
  - t. Testing and inspecting requirements.
  - u. Installation procedures.
  - v. Coordination with other work.
  - w. Required performance results.
  - x. Protection of adjacent work.
  - y. Protection of construction and personnel.
- 3. Contractor shall record significant conference discussions, agreements, and disagreements, including required corrective measures and actions and distribute minutes of the meeting to each party present, Engineer, Owner's representative, and other parties upon request.
- 4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- 5. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Engineer, but no later than 30 days prior to the scheduled date of Substantial Completion. Electronic meetings shall be conducted by Contractor at the request of the Engineer for conference for Engineer's participation remotely:
- 6. Conduct the conference to review requirements and responsibilities related to Project closeout.
- 7. Attendees: Contractor and its superintendent. The Owner, Engineer, and their consultants; major subcontractors; suppliers; and other concerned parties may

- also attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
- Agenda: Discuss items of significance that could affect or delay Project closeout, 8. including the following:
  - a. Preparation of record documents.
  - Procedures required prior to inspection for Substantial Completion and for b. final inspection for acceptance.
  - Submittal of written warranties. C.
  - Requirements for preparing operations and maintenance data. d.
  - Requirements for demonstration and training. e.
  - Preparation of Contractor's punch list. f.
  - Procedures for processing Applications for Payment at Substantial g. Completion and for final payment.
  - Submittal procedures. h.
- D. Progress Meetings: Contractor shall conduct progress meetings at regular intervals but not less than monthly unless mutually agreed by Owner and Engineer. Electronic meetings shall be conducted by Contractor at the request of the Engineer for conferences for Engineer's participation and others remotely:
  - 1. Coordinate dates of meetings with preparation of payment requests. Coordinating dates of meetings will be discussed at the Pre-Construction Conference.
  - 2. Attendees: In addition to representatives of Owner, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning. coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project:
    - Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time:
      - Review schedule for next period.
    - Review present and future needs of each entity present, including the b. following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - Status of submittals. 3)
      - Deliveries. 4)
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - Temporary facilities and controls. 8)
      - 9) Progress cleaning.
      - Quality and work standards. 10)
      - Status of correction of deficient items. 11)

- 12) Field observations.
- 13) Status of RFIs.
- 14) Status of proposal requests.
- 15) Pending changes.
- 16) Status of Change Orders.
- 17) Pending claims and disputes.
- 18) Documentation of information for payment requests.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information:
- 5. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- 6. Coordination Meetings: Contractor shall conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences:
  - a. Attendees: Each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
- 7. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project:
  - a. Review progress since the last coordination meeting. Determine whether work is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  - b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
  - c. Review present and future needs of each contractor present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Work hours.
    - 10) Hazards and risks.
    - 11) Progress cleaning.
    - 12) Quality and work standards.
    - 13) Change Orders.
    - 14) Testing and jurisdictional approvals

- 15) Utility tie-ins and tap fees/assessments.
- 8. Reporting: Contractor shall record meeting results and distribute copies to everyone in attendance, Engineer, Owner's Representative and to others affected by decisions or actions resulting from each meeting.

# 1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Engineer's Digital Data Files: Digital data files of Engineer's REVIT drawings can be provided by Engineer for Contractor's use during construction by request of Contractor.
  - 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
  - 2. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
  - 3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement or Agreement form acceptable to Owner and Engineer or use Engineer's release form as the discretion of the Engineer.
  - 4. Subcontractors and other parties granted access by Contractor to Engineer's digital data files shall execute a data licensing agreement in the form of AIA Document C106 or Agreement acceptable to Owner and Engineer or use Engineer's release form at the discretion of the Engineer.
  - 5. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion. Web-based Project management software includes, at a minimum, the following features:
    - a. Compilation of Project data, including Contractor, subcontractors, Engineer, Engineer's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    - c. Document workflow planning, allowing customization of workflow between project entities.
    - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    - e. Track status of each Project communication in real time, and log time and date when responses are provided.
    - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
    - g. Processing and tracking of payment applications.
    - h. Processing and tracking of contract modifications.
    - i. Creating and distributing meeting minutes.
    - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
    - k. Management of construction progress photographs.

- I. Mobile device compatibility, including smartphones and tablets.
- m. Provide and coordinate licenses to the Owner's representative, and the Project Design team. Provide eight hours of software training at Engineer's office for web-based Project software users.
- n. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Engineer. Provide data in locked format to prevent further changes.
- o. Provide one of the following Project management software packages under their current published licensing agreements:
  - 1) Autodesk; BIM360 (Engineer is current user).
  - 2) The Simplex Group Inc.
  - 3) Meridian Systems; Prolog.
  - 4) Newforma, Inc.
  - 5) Procore Technologies, Inc.
  - 6) Viewpoint, Inc.;
- p. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare as follows:
  - Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2) Name file with submittal number or other unique identifier, including revision identifier.
  - 3) Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.9 PRIME TRADE CONTRACTOR'S USE OF PREMISES

- A. Contractors shall limit their use of the premises for work and for storage.
- B. Contractors shall conduct their operations to ensure the least inconvenience to the occupants and the general public.
- C. Contractors shall assume full responsibility for the protection and safekeeping of products under its Contract stored on the site.
- D. Contractors shall move any stored products that interfere with operations of the Owner.
- E. Contractors shall obtain and pay for the use of additional storage or work areas needed for their operations.
- F. Contractors shall not load structures with weights which will endanger the structure.

# 1.10 SOFTWARE AND E-MAIL REQUIREMENTS

A. Contractors shall own, operate, and maintain software that is compatible with software used by the Engineer. Microsoft Word®, Microsoft Excel®, and Adobe Acrobat Reader® are the standard word processing, spreadsheet, and read only programs, respectively, used by the Engineer. Standard forms and templates will be issued to and required to

be utilized by each Contractor during the execution of the Project. Contractors should also familiarize themselves with the Microsoft Project software that will be used for CPM scheduling purposes. Any software related to BIM including Autodesk Revit and Navisworks.

- B. Contractor shall have the capability to send and receive e-mail via the internet.
- C. Contractors shall submit ALL project documentation electronically via e-mail to the Engineer and Owner's Representative unless prior approval has been obtained from the Engineer.
- D. Contractors shall have internet capabilities on-site. On-Site Superintendents shall have the ability to create and receive emails via computer, tablet or equivalent.

#### 1.11 TIME OF COMPLETION

- A. Subject to change based on award of the project, delivery of materials and Contractor means and methods the major milestones for the construction are projected to be as follows but subject to change based on the Contractors progress:
  - 1. Notice to Proceed: March 15, 2022.
  - 2. Substantial Completion Phase 1: October 2022.
  - Lag Time anticipated when central heating system is active in October 2022 until May 2023.
  - 4. Resume on-site construction activities not later than May 2023.
  - 5. Substantial Completion Phase 2: November 15, 2023.
  - 6. Final Completion: December 15, 2023.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

# SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 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 start-up construction schedule.
  - 2. Contractor's construction schedule.
  - 3. Daily construction reports.
  - 4. Field condition reports.
  - 5. Special reports.

# B. Related Sections:

- 1. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
- 2. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

# 1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals electronically (PDF).
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- C. Daily Construction Reports: Submit at weekly intervals.
- D. Material Location Reports: Submit at monthly intervals.
- E. Field Condition Reports: Submit at time of discovery of differing conditions.
- F. Special Reports: Submit at time of unusual event.

### 1.4 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
  - 1. Review software limitations and content and format for reports.
  - 2. Verify availability of qualified personnel needed to develop and update schedule.
  - 3. Discuss constraints, including phasing work stages area separations interim milestones and partial Owner occupancy.
  - 4. Review delivery dates for Owner-furnished products.
  - 5. Review schedule for work of Owner's separate contracts.
  - 6. Review time required for review of submittals and resubmittals.
  - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
  - 8. Review time required for completion and startup procedures.
  - 9. Review and finalize list of construction activities to be included in schedule.
  - 10. Review submittal requirements and procedures.
  - 11. Review procedures for updating schedule.

### 1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. 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 Work from entities involved.
  - 2. Coordinate each construction activity in network with other activities and schedule them in proper sequence.

### PART 2 - PRODUCTS

### 2.1 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. Count of personnel at Project site.
  - 4. Equipment at Project site.
  - Material deliveries.

- 6. High and low temperatures, general weather conditions, including presence of rain or snow.
- 7. Accidents.
- 8. Meetings and significant decisions.
- 9. Unusual events (refer to special reports).
- 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.
- B. Field Condition Reports: Immediately on discovery of a difference between field 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.

### 2.2 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

### PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Comply with schedule requirements in Section 013000.

## **END OF SECTION 013200**

### SECTION 013300 - SUBMITTAL PROCEDURES

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

# 1.2 SUMMARY

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

#### B. Related Sections:

- 1. Division 1 Section "Payment Procedures".
- 2. Division 1 Section "Construction Progress Documentation".
- 3. Division 1 Section "Project Record Documents".
- 4. Division 1 Section "Operation and Maintenance Data".
- C. If submittals are rejected twice, Contractor shall reimburse the Owner for any additional time and materials required by the Engineer of Record to review any further submittals; Contractor shall agree to submit appropriate documentation to support a deductive change order to the Contract by a date stipulated by the Owner; the deduct shall be equivalent to the amount of expenses incurred by the Owner for such additional services. No time extension will be granted for project completion resulting from submittals being rejected.

# 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Engineers responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Engineers responsive action. Submittals may be rejected for not complying with requirements.

### 1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities:
  - Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination:
    - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
  - 3. Submittals delivered to the Architect's office after 3:00 pm local time, shall be deemed to be received on the next business day.

# 1.5 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule 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 modifications to submittals noted by the Engineer and additional time for handling and reviewing submittals required by those corrections:
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule:
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
  - 5. Specification Section number and title.
  - 6. Name of subcontractor.
  - 7. Description of the Work covered.
  - 8. Scheduled date for Engineer's final release or approval.

# 1.6 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Engineer's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be made available by Engineer and Consultant's for Contractor's use in preparing submittals. Nominal fees and Engineer's electronic release must be executed before transferring appropriate documents:
  - 1. Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

- 2. Digital Drawing Software Program: Contract Drawings are available in AutoCAD format.
- 3. Engineer will provide the Contractor a data licensing agreement prior to the release of any digital drawing files.
- 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. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination:
    - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer'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. For reviews made directly by the Engineer, allow 7 to 10 days for initial review and processing of each submittal. Less complicated submittals will take a shorter amount of time for review, while more complicated submittals will take a longer amount of time for reasonable review. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
- D. Resubmittal Review: Allow 15 days for review of each resubmittal.
- E. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow 21 days for review of each submittal. Submittal will be returned to Engineer before being returned to Contractor. Review times are dependent upon the complexity of each submittal; less complicated submittals will take a shorter amount of time for reasonable review, while more complicated submittals will take a longer amount of time for reasonable review.
- F. No extension of the Contract Time will be authorized because of failure to transmit submittals in advance of the work to allow for proper processing and review.
- G. Identification and Information: Place a permanent label or title block on each submittal item for identification:
  - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
- H. Provide a space approximately 4" x 5" on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
- I. Include the following information for processing and recording action taken:

- 1. Project name.
- Date.
- 3. Name of Engineer.
- 4. Name of Contractor.
- 5. Name of subcontractor.
- 6. Name of supplier.
- 7. Name of manufacturer.
- 8. Submittal number or other unique identifier, including revision identifier.
- 9. Number and title of appropriate Specification Section.
- 10. Drawing number and detail references, as appropriate.
- 11. Location(s) where product is to be installed, as appropriate.
- 12. Other necessary identification.
- J. Options: Identify options requiring selection by the Engineer.
- K. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals. Failure to identify deviations may allow Engineer to reject and require resubmittal.
- L. Additional Paper Copies/Electronic Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal:
  - 1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer
  - 2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- M. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form electronically in organized PDF format (or in electronic format as agreed to by Engineer). Engineer will return submittals, without review, received from sources other than Contractor:
  - 1. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
  - 2. Date.
  - 3. Destination (To:).
  - 4. Source (From:).
  - 5. Names of subcontractor, manufacturer, and supplier.
  - 6. Category and type of submittal.
  - 7. Submittal purpose and description.
  - 8. Specification Section number and title.
  - 9. Indication of full or partial submittal.
  - 10. Drawing number and detail references, as appropriate.
  - 11. Transmittal number.
  - 12. Submittal and transmittal distribution record.
  - 13. Remarks.
  - 14. Signature of transmitter.
- N. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

- O. 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.
- P. Use for Construction: Use only final submittals that are marked with action taken by Engineer in connection with construction.

#### PART 2 - PRODUCTS

# 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections:
  - Action Submittals: Submit one (1) electronic organized PDF (or format approved by Engineer). Engineer will return electronic copy to distribute to subcontractors and suppliers. Provided three (3) paper copies of each submittal after electronic submissions are completed, unless otherwise indicated or requested by Engineer. Contractor to retain two copies as Project Record Documents.
  - 2. Informational Submittals: Submit one (1) electronic organized PDF (or format approved by Engineer). Engineer will return electronic copy to distribute to subcontractors and suppliers. Provided three (3) paper copies of each submittal after electronic submissions are completed, unless otherwise indicated or requested by Engineer. Engineer will not return copies.
  - 3. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."
  - 4. Certificates and Certifications Submittals: Provide 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.
  - 5. Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section "Quality Requirements."
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
  - 4. Manufacturer's product specifications.
  - 5. Standard color charts.
  - 6. Statement of compliance with specified referenced standards.
  - 7. Testing by recognized testing agency.
  - 8. Application of testing agency labels and seals.
  - 9. For equipment, include the following in addition to the above, as applicable:

- a. Wiring diagrams showing factory-installed wiring.
- 10. Printed performance curves.
- 11. Operational range diagrams.
- 12. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 13. Submit Product Data before or concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale in 2D drawings. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based upon Engineer's digital data drawing files is otherwise permitted:
- D. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
  - 1. Dimensions
  - 2. Identification of products.
  - Fabrication and installation drawings.
  - 4. Roughing-in and setting diagrams.
  - 5. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - 6. Shop work manufacturing instructions.
  - 7. Templates and patterns.
  - 8. Schedules.
  - 9. Compliance with specified standards.
  - 10. Notation of coordination requirements.
  - 11. Notation of dimensions established by field measurement.
  - 12. Relationship and attachment to adjoining construction clearly indicated.
  - 13. Seal and signature of professional engineer if specified.
- E. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 30" x 42" in electronic format for review then hard copies for final.
- F. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed:
  - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
  - 3. Product name and name of manufacturer.
  - 4. Sample source.
  - 5. Number and title of applicable Specification Section.
  - 6. 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 three (3) full set(s) of available choices where color, pattern, texture or similar characteristics are required to be selected

from manufacturer's product line. Engineer will return submittal with options selected.

- 7. 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 (3) sets of Samples. Engineer will retain two (2) Sample sets; remainder will be returned:
    - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
  - b. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.
- G. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product.
  - 2. Manufacturer and product name, and model number if applicable.
  - 3. Number and name of room or space.
  - 4. Location within room or space.
- H. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- I. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."
- J. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."
- K. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entities performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
- L. Drawing number and detail references, as appropriate, covered by subcontract.
- M. Submit subcontract list in the following format:
- N. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

- O. 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 Engineers and owners, and other information specified.
- P. 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 American Welding Society (AWS) forms. Include names of firms and personnel certified.
- Q. 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.
- R. 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.
- S. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- T. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- U. 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.
- V. Product Test Reports: Submit written reports indicating 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.
- W. 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:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
- X. Description of product.
- Y. Test procedures and results.
- Z. Limitations of use.
- AA. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

- BB. 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.
- CC. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- DD. Field Test Reports: Submit 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.
- EE. Maintenance Data: Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."
- FF. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

# PART 3 - EXECUTION

# 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

# 3.2 ENGINEER'S ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return to Contractor. Engineer will stamp each

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submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

- 1. Furnish as Submitted
- 2. Furnish as Noted
- 3. Revise and Resubmit
- 4. Resubmittal Not Required
- 5. Rejected
- C. Informational Submittals: Engineer will review each submittal and will not return it or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

### SECTION 014000 - QUALITY REQUIREMENTS

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements:
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections and related actions do not limit Contractor's other quality assurance and control procedures that facilitate compliance with Contract Documents.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner or authorities having jurisdiction are not limited by provisions of this Section.

#### C. Related Sections:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.

#### 1.3 DEFINITIONS

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

- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.
- C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged:
  - 1. Integrated Exterior Mockups: Metal Fascia, Metal Copings, Gutter and Downspouts, and sealants.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Inspections that are performed on-site for installation of the Work and for completed Work.
- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations:
  - Use of trade-specific terminology in referring to a trade or entity does not require
    that certain construction activities be performed by accredited or unionized
    individuals, or that requirements specified apply exclusively to specific trade or
    trades.

### 1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: Quantity or quality level shown or specified shall be the minimum provided or performed. Actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.

### 1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspection.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices,

receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

# 1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems like those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products like those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are like those indicated for this Project in material, design, and extent.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated:
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities:
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Engineer.
  - 2. Notify Engineer seven (7) days in advance of dates and times when mockups will be constructed.
  - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
  - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 5. Obtain Engineer's approval of mockups before starting work, fabrication, or construction.
  - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 7. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.
- L. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished in accordance with requirements. Provide required lighting and additional lighting where required to enable Engineer to evaluate quality of the Work.

### 1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services:
  - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not:
  - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

- 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services:
  - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
- 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
- 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."
- D. Retesting/Reinspection: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspection, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections:
  - 1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality- control service through Contractor.
  - 5. Do not release, revoke, alter or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.

- 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
- 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required qualityassurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting:
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses:
  - 1. Distribution: Distribute schedule to Owner, Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

### 3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Engineer.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

### 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes:
  - Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 1 Section "Execution Requirements."
- B. Protect construction exposed by or for quality-control service activities.

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

END OF SECTION 014000

#### SECTION 014200 - REFERENCES

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents:
  - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents:
  - 1. AABC Associated Air Balance Council; <a href="www.aabc.com">www.aabc.com</a>, www.aabc.com
  - 2. AAMA American Architectural Manufacturers Association; <a href="https://www.aamanet.org">www.aamanet.org</a>, www.aamanet.org
  - 3. AASHTO American Association of State Highway and Transportation Officials; <a href="https://www.transportation.org">www.transportation.org</a>www.transportation.org
  - 4. ABMA American Bearing Manufacturers Association; <a href="https://www.americanbearings.org">www.americanbearings.org</a> Association;
  - 5. ABMA American Boiler Manufacturers Association; www.abma.comwww.abma.com.
  - 6. ACI American Concrete Institute; (Formerly: ACI International); www.concrete.org
  - 7. AEIC Association of Edison Illuminating Companies, Inc. (The); www.aeic.orgwww.aeic.org.
  - 8. AGA American Gas Association; <a href="www.aga.org">www.aga.org</a>www.aga.org.
  - 9. AHRI Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.orgwww.ahrinet.org.
  - 10. Al Asphalt Institute; www.asphaltinstitute.org.
  - 11. AIA American Institute of Architects (The); www.aia.orgwww.aia.org.
  - 12. AISC American Institute of Steel Construction; www.aisc.orgwww.aisc.org.
  - 13. AISI American Iron and Steel Institute; www.steel.orgwww.steel.org.
  - 14. AMCA Air Movement and Control Association International, Inc.; www.amca.orgwww.amca.org.
  - 15. ANSI American National Standards Institute; <a href="www.ansi.org">www.ansi.org</a>, www.ansi.org
  - 16. API American Petroleum Institute; <a href="www.api.org">www.api.org</a>.
  - 17. ARI Air-Conditioning & Refrigeration Institute; (See AHRI).
  - 18. ASCE American Society of Civil Engineers; www.asce.orgwww.asce.org.

- 19. ASCE/SEI American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
- 20. ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers; <u>www.ashrae.org</u>www.ashrae.org.
- 21. ASME ASME International; (American Society of Mechanical Engineers); www.asme.org
- 22. ASTM ASTM International; <u>www.astm.org</u>www.astm.org.
- 23. AWS American Welding Society; www.aws.orgwww.aws.org.
- 24. CISPI Cast Iron Soil Pipe Institute; <a href="www.cispi.org">www.cispi.org</a>.
- 25. CRSI Concrete Reinforcing Steel Institute; <a href="www.crsi.org">www.crsi.org</a>. www.crsi.org
- 26. CSI Construction Specifications Institute (The); <u>www.csinet.org</u>www.csinet.org.
- 27. FM Approvals FM Approvals LLC; <u>www.fmglobal.com</u>www.fmglobal.com.
- 28. HI Hydraulic Institute; <a href="www.pumps.org">www.pumps.org</a>.
- 29. HMMA Hollow Metal Manufacturers Association; (See NAAMM).
- 30. IEEE Institute of Electrical and Electronics Engineers, Inc. (The); <a href="https://www.ieee.org">www.ieee.org</a>, www.ieee.org
- 31. IES Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); <a href="https://www.ies.org.">www.ies.org</a>.
- 32. MSS Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; <a href="https://www.mss-hq.org">www.mss-hq.org</a>, www.mss-hq.org
- 33. NAIMA North American Insulation Manufacturers Association; <a href="https://www.naima.org">www.naima.org</a> www.naima.org
- 34. NCMA National Concrete Masonry Association; www.ncma.orgwww.ncma.org.
- 35. NEMA National Electrical Manufacturers Association; <a href="https://www.nema.org">www.nema.org</a> www.nema.org
- 36. NFPA National Fire Protection Association; <u>www.nfpa.org</u>www.nfpa.org.
- 37. NSPE National Society of Professional Engineers; www.nspe.orgwww.nspe.org.
- 38. PDI Plumbing & Drainage Institute; www.pdionline.orgwww.pdionline.org.
- 39. SDI Steel Deck Institute; www.sdi.orgwww.sdi.org.
- 40. SDI Steel Door Institute; www.steeldoor.orgwww.steeldoor.org.
- 41. SJI Steel Joist Institute; <u>www.steeljoist.org</u>www.steeljoist.org.
- 42. SMACNA Sheet Metal and Air Conditioning Contractors' National Association; <a href="https://www.smacna.org">www.smacna.org</a>www.smacna.org
- 43. UL Underwriters Laboratories Inc.:
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents:
  - 1. ICC International Code Council; www.iccsafe.orgwww.iccsafe.org.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents:
  - 1. DOE Department of Energy; <a href="www.energy.gov">www.energy.gov</a>.
  - 2. EPA Environmental Protection Agency; www.epa.govwww.epa.gov.
  - 3. GSA General Services Administration; www.gsa.govwww.gsa.gov.
  - 4. OSHA Occupational Safety & Health Administration; www.osha.gov.

# GSD-221-C

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents:
  - CFR Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsyswww.gpo.gov/fdsys.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

### SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 SECTION REQUIREMENTS

- A. Standards: Comply with NFPA 241, "Standard for Safeguarding Construction, Alterations, and Demolition Operations"; ANSI A10 Series standards for "Safety Requirements for Construction and Demolition"; and NECA Electrical Design Library's "Temporary Electrical Facilities."
- B. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. At the earliest possible time, when acceptable to Owner, change over from use of temporary utility services to use of permanent utilities.
- D. Remove temporary facilities and controls before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

### 1.3 TEMPORARY SERVICES AND SUPPORT FACILITIES

A. Provide all labor, material, tools, equipment, services, and insurance for the complete provision of Temporary Services and Support Facilities including but not limited to:

# 1.4 TEMPORARY FACILITIES AND CONTROLS

A. Unless otherwise specified, Contractor shall furnish, install and maintain temporary facilities and controls required for construction for its own construction personnel. Contractor shall remove such temporary facilities and controls upon completion of its Work. All facilities and controls shall comply with Federal, State, and local codes, and safety regulations.

- B. Contractor shall provide construction aids and equipment required to assure safety for its personnel and to facilitate the execution of the Work: scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such equipment. All such equipment shall meet current OHSA requirements.
- C. Contractor must maintain Emergency Egress throughout all phases of construction in the building. The Contractor shall provide additional protection of fencing required to accommodate any such request by the Authority Having Jurisdiction.

# 1.5 TEMPORARY HOISTS, SCAFFOLDS AND PROTECTION

- A. Contractor shall be solely responsible for hoisting its materials and equipment for the Project as required. The Owner's representative shall approve the locations of access for hoisting equipment. The Owner's representative shall designate material storage areas for Contractor.
- B. Contractor shall advise the Owner's representative and obtain its permission in advance for any hoisting equipment Contractor requires. Contractor shall be solely responsible for the maintenance, repair, operation, installation, and removal of such hoisting equipment. This responsibility shall include the costs incurred by other subcontractors resulting from out of sequence work, patching and/or repair made necessary because of the equipment furnished by the Contractor.
- C. Contractor shall not permit material hoists to be used as passenger elevators under any circumstances.
- D. Contractor shall provide, install, and maintain protective floor coverings on all finished floor surfaces that lifts or scaffolding shall be utilized on. Protective covering(s) shall be coordinated with the Owner's Representative.
- E. Contractor shall provide, erect, and maintain scaffolding, staging, platforms, temporary runways, temporary flooring, guards, railings, enclosures, stairs and other items required for execution of its Work and for protection of workmen and the public. Contractors shall comply with all applicable OSHA requirements and with requirements of other authorities having jurisdiction.

#### 1.6 TEMPORARY FENCING

- A. Contractor shall install temporary construction fencing as needed throughout the construction process to maintain egress/ingress.
- B. Temporary removal and reinstallation required for access is the responsibility of the Contractor.
- C. The Contractor shall remove all temporary fencing, including any posts and concrete upon the completion of the project.

### 1.7 TEMPORARY ENCLOSURES

- A. The Contractor shall provide exterior temporary enclosure(s) for protection of construction Work in progress and completed; from exposure, foul weather, intrusion, security, other construction operations and similar activities.
- B. The Contractor shall be responsible for all temporary weather protection and for maintaining a "weather-tight" enclosure for their and other trades work associated with the roofing system.
- C. Where heat is required and the permanent building enclosure is not complete, Contractor shall provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosures with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- D. All materials used for temporary enclosures shall be constructed of fire-retardant materials. Any wood used for the framing of temporary enclosures shall be non-combustible. Install tarpaulins or plastic materials securely, with noncombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials. All temporary enclosures shall be capable of withstanding wind speeds of 70 miles per hour or greater. Visqueen shall be non-combustible as well.
- E. Contractor shall be responsible for maintaining security of the building from intrusion and theft. This includes but is not limited to the areas requiring removal of exterior walls, windows and doors.

# 1.8 TEMPORARY PROTECTION AND BARRICADES

- A. Contractor shall provide barricades, fences, rails, covers, temporary walks, signs, signals, lights and other safety or warning devices adequate for protection of the public, Owner employees, Engineer, and other construction employees, required by or because of the Work.
- B. Contractor shall be responsible for all required OSHA temporary protection and barricades necessary for the completion of its Work.
- C. Contractor shall provide, maintain and remove all required and necessary building perimeter barricades and temporary enclosures at all openings.
- D. Temporary removal and reinstallation required for access is the responsibility of Contractor requiring such access.
- E. Contractor shall provide protection for plant life designated to remain. Replace damaged plant life at no additional cost to the Owner(s).
- F. Contractor shall protect non-company owned vehicles, stored materials, site and structure(s) from damage. Any damage to any non-company owned vehicles, stored materials, site and structure(s) resulting from inadequate protection shall be the responsibility of the Contractor who failed to provide adequate protection.

### 1.9 ACCESS ROADS AND VEHICLES

- A. The Contractor shall arrange for and maintain the Temporary Construction Office and Storage Areas, temporary roads and walks and Parking areas to achieve all weather access into the site from public thoroughfares and within and adjacent to the site as necessary to provide uninterrupted access to field offices, Work and storage areas and parking areas from issuance of Notice to Proceed, until Contract Completion. The Contractor shall be responsible for snow removal from the Temporary Construction Office and Storage Areas, paved & stoned drives, parking lots, and walkways to maintain the Work and access areas in a clear and safe condition from issuance of Notice to Proceed, until Contract Completion. Use of deicing agents shall be used only with the approval of the Owner's representative and under no condition shall they contain chlorides. Contractor is required to provide snow and ice removal at their trailer and immediate Work areas. Contractors requiring special access roads shall provide, maintain, and remove such roads at no additional cost to the Owner. The location of special access roads shall be coordinated by the Owner's representative in advance.
- B. Contractors using public roads, streets and other transportation facilities at the site shall conform to all local regulations regarding load limits. If the Work of a Contractor requires that such facilities be temporarily discontinued, after obtaining from Owner's representative, the Work shall be done expeditiously and detour roads, bridges or other temporary structures shall be erected by such Contractor and maintained as directed. All damage to streets, public roads, or other transportation facilities shall be repaired and/or replaced as directed by the Contractor responsible for the damage.
- C. At all points where vehicles will enter paved streets, Contractor shall prevent mud from being carried onto such adjacent paved streets. Contractor shall ensure that all trucks or other vehicles related to its Work leaving the site at any time shall be clean of mud and dirt clinging to wheels and exterior body surfaces. When mud is deposited on paved streets, the Contractor shall immediately clean such street completely. Failure of the Contractor to immediately clean the streets shall not be tolerated. Mud and debris deposited on streets and not immediately cleaned shall be cleaned by the Owner and ALL costs back-charged to the Contractor from its next progress payment due.
- D. Cleaning of concrete equipment shall be performed at a location designated by the Owner's representative. Contractor performing concrete Work shall remove from the site all residue accumulated from the cleaning operations of concrete equipment at least once per week.
- E. All trucks leaving the site with earthen materials or loose debris shall be loaded in a manner that will prevent dropping of materials on streets and shall have suitable coverings fastened over the load before they enter surrounding paved streets. Trucks bringing earthen materials over paved streets to the site shall be similarly loaded and covered.
- F. The Contractor shall meet with the local authorities to inspect and digitally record all public roads servicing the project site prior to commencement of work to identify and record current road and adjacent drainage conditions. One (1) copy of the digital recordings shall be submitted to the Owner's representative for record in DVD format.

- G. The Contractor shall be responsible for the continual maintenance of the drives and parking areas within the construction limits from issuance of Notice to Proceed, until Contract Completion. Drive and Parking Area surfaces shall be maintained free from ruts, deep tracks, depressions, furrows, etc. The Contractor shall maintain the Drive and Parking Area surface within the construction limits, including contractor job trailer area and parking/lay down area, aggregate base installed by Contractor or pavement installed by the Contractor free from deleterious material including but not limited to mud, silt, spilled building materials, trash, and debris.
- H. Contractor shall be responsible for general snow removal at all drives, access points, and parking areas within the construction limits. Contractor shall drain, correct and prevent accumulation of water and standing water that has been created by the construction operations around the Drives and Parking Areas. WATER ACCUMULATION WILL NOT BE PERMITTED. The Owner will be responsible for the snow removal from all drives and parking areas outside of the construction limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

#### 3.1 TEMPORARY UTILITIES

- A. Provide temporary utility services to existing facilities during interruptions of permanent utilities. Arrange for and coordinate utility services with Owner and local utility companies.
- B. Owner will pay use charges for temporary utilities (electric, gas, and water).
- C. Provide temporary heat for curing or drying of work, and for protection of new construction from adverse effects of low temperatures. Use of gasoline-burning and open-flame heaters is not permitted.

# 3.2 CONSTRUCTION FACILITIES

- A. Provide field offices, storage trailers, and other support facilities as necessary for efficient prosecution of the Work.
- B. Temporary facilities located within the construction area or within 30 feet of building lines shall be of noncombustible construction.
- C. Provide temporary sanitary facilities. Comply with regulations and health codes for type, number, location, and maintenance of facilities.
- D. Provide temporary enclosures for protection of construction and workers from exposure and inclement weather and for containment of heat.

- E. Install project identification and other signs in locations approved by Owner to inform the public and persons seeking entrance to Project.
- F. Collect waste daily and, when containers are full, legally dispose of waste off-site.
- G. Handle hazardous, dangerous, or unsanitary waste materials in separate closed waste containers. Dispose of material per applicable laws and regulations.

# 3.3 TEMPORARY CONTROLS

- A. Contractor shall establish a perimeter fence separating the construction staging area from the occupied areas. The exact location of this will be field confirmed at the site.
- B. Provide temporary fire protection until permanent systems supply fire-protection needs.
- C. Provide adequate numbers and types of fire extinguishers.
- D. Store combustible materials in fire-safe containers in fire-safe locations.
- E. Tobacco products are not allowed on property.
- F. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
- G. Provide temporary barricades, warning signs, and lights to protect the public and construction personnel from construction hazards.
- H. Enclose construction areas with fences with lockable entrance gates, to prevent unauthorized access.
- I. Provide temporary environmental controls as required by authorities having jurisdiction including, but not limited to, erosion and sediment control, dust control, noise control, and pollution control.

### 3.4 USE OF PREMISES

### A. Occupancy of Premises:

- 1. Before work is started, Contractor shall arrange with Owner a sequence of procedure, means of access, space for storage of materials and equipment use of approaches.
- 2. During the construction operation, access to the existing building (when applicable), and existing buildings adjacent to the site is strictly restricted. No one person or persons, Contractor, employee, representative, Subcontractor, or any other person related to the work herein, without express consent and confirmation of the Owner, shall enter any building, structure or gathering place other than the immediate site necessary for these construction operations. Due to the nature of the work, it is foreseen that intrusion in these areas shall, at times, be necessary.

- In this event, the Owner shall be notified in advance so that all such work may be performed at said Owner's convenience.
- 3. Equipment on Site: Equipment to remain in place within the area of contract operations shall be covered and protected against damage or loss. Equipment removed in performance of work under the contract which is to be re-used or become the property of the Owner shall be stored on the premises where directed, or shall be re-used in work as shown or specified. Equipment temporarily removed shall be protected, cleaned and replaced equal to its condition prior to starting work under the contract. Security for equipment or material to be re-used or removed for temporary storage shall be the responsibility of the Contractor.
- 4. Area Designated for Material Storage: Materials on site must be properly stored in trailers provided by Contractor and secured. The Owner will not take responsibility for any materials or equipment on site. Locations for such storage trailers will be in an area designated by the Owner.
- 5. Hauling, Moving and Trucking: At all points, where trucks leave the project and enter adjacent pavement or streets, General Contractor shall maintain a crew to prevent any mud or debris from being carried onto adjacent pavement or streets. Earth, loose materials or debris deposited on such areas due to trucking activities shall be removed daily. Contractor shall conform to all local regulations regarding load limits.

#### B. Protection:

- 1. Property: Contractor and each Subcontractor shall take such precautions necessary to adequately protect from damage or deterioration and to safeguard from theft or pilferage, all materials, tools and equipment pertaining to his work which are on the site.
- 2. Safety: Contractor and each Subcontractor shall provide all barricades or other temporary protection as may be required by local authorities having lawful jurisdiction, or by consideration of general safety, around all openings in floors and walls of the structure, and around all open pits or trenches in its vicinity.
- 3. Weather: Contractor and each Subcontractor shall provide protection against rain, wind, storms, frost or heat to maintain all work, materials, apparatus and fixtures free from injury or damage.
- 4. Water: Contractor shall protect excavation, trenches and building from damage caused by rain water, spring water, ground water, backing up of drains or sewers, and all other water. He shall provide all pumps and equipment and enclosures required for such protection.
- 5. He also shall construct and maintain any temporary drainage necessary to direct or lead water away from the excavation and shall do all pumping necessary to keep excavation and lowest floor or pit free of water throughout the construction period.
- 6. Damage: All work damaged by failure to provide protection shall be removed and replaced with new work at expense of Contractor at fault.

#### C. Protection – Owners and Adjoining Property:

- 1. Contractor shall protect the Owner's property from injury or loss arising in connection with this Contract. He shall adequately protect adjacent property as provided by law and the Contract Documents.
- 2. In an emergency affecting the safety of life, of the work or of adjoining property, the Contractor without special instruction or authorization from the Owner is hereby

permitted to act, at his discretion, to prevent such threatened loss or injury, and he shall so act with arrear if so instructed or authorized. Any compensation claimed by the Contractor because emergency work shall be determined by agreement.

# D. Access and Inspection:

- 1. Permit access to building and site for Owner or its agents. Do not allow entry to premises by anyone not engaged on the Work or having a lawful authority to enter for purposes of inspection.
- 2. Owner representatives and representatives of agencies having lawful jurisdiction shall always have access to the work wherever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection.
- 3. In the specifications, the Owner's instructions or laws or ordinances of any public authority require any work to be specially tested or approved, the Contractor shall give the Owner or other inspecting authority timely notice of its readiness for inspection and, if the inspection is by an authority other than the Owner, the date fixed for such inspection. Inspections by the Owner shall be promptly made and, where practicable, at the source of supply. If any work should be covered up without approval or consent of the Owner, it must, if required by Owner, be uncovered for examination at the Contractor's expense.
- 4. Re-examination of questioned work may be ordered by the Owner and, if so ordered, the work must be uncovered by the General Contractor who shall engage the services of appropriate Subcontractors for trades whose work will be needed for uncovering of questioned work, and subsequent replacement. If such work were found not in accordance with the Contract Documents, the Contractor shall pay such cost.

# E. Cleaning and Protection:

- During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering on installed work where it is required to ensure freedom from damage or deterioration at time of Substantial Completion.
- 2. Clean and maintain completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- 3. Conservation and Salvage: It is a requirement for supervision and administration of the work that construction operations be carried out with the maximum possible consideration given to conservation of energy, water and materials. In addition, maximum consideration shall be given to salvaging materials and equipment involved in performance of the work but not incorporated therein. Refer to other sections for required disposition of salvage materials which are the Owner's property.
- 4. Safety Plan: Contractor must develop safety plan for the duration of the construction.
- 5. Safety Plan should highlight specific high-risk activities and detail the safety considerations, identify the potential hazard, and describe implementation measures to address hazards.
- 6. Safety Plan should provide site specific information for responding to an emergency when working from heights with limited access.

- 7. Ensure that appropriate first responders have been notified of scope of project and verify the ability to access all work areas in the event a rescue is required.
- 8. Safety Plan should identify and provide contact information for designated safety personnel and alternates in case of primary personnel absence.
- 9. Safety Plan should identify typical site safety requirements, to include appropriate Personal Protection Equipment (PPE) for all tasks to be completed as part of the Scope of Work.
- 10. Safety Plan shall contain a narrative describing measures for fall protection where necessary and safety provisions for the Work.
- 11. Safety Plan shall follow guidelines of "Jobsite Safety Handbook" for the Department of Administration and the General Services Division. Prior to beginning any work on the jobsite, Contractor must acknowledge the Owner's "Jobsite Safety Handbook".
- 12. Contractor is responsible for complying with all safety, health and sanitation laws.
- 13. Contractor shall submit a copy of the Safety Plan to the GSD Project Manager prior to starting work.
- 14. Contractor shall notify GSD when outside safety agencies including Fire Marshall and OSHA are on site.

**END OF SECTION 015000** 

# **Jobsite Safety Handbook**

# **For Contractors**

# **Department of Administration (DOA)**

**General Services Division (GSD)** 

218 California Avenue Charleston, WV

THIS HANDBOOK IS TO BE POSTED IN A VISIBLE AREA AT ALL CONSTRUCTION PROJECTS AND/OR CONTRACTOR WORKSITES

Contractor Contact:		Phone #:			
EMERGENCY CONTACTS:					
Project Manager:					
Name:	Pr	none #;			
Emergency Services #:					
GSD Safety Section:					
1900 Kanawha Boulevard East, Bldg 1 Room MB12 Charleston, WV 25305					
Jonathan Trout:	Work# 304 352-5522	Cell# 304-205-2721			
Marsha Bowling	Work# 304-352-5523	Cell# 304-951-1410			

Revision 4/18/22

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# **JOBSITE SAFETY HANDBOOK**

The following is a summary of applicable jobsite safety requirements. This handbook is intended to be used as a guide and in no way reflects all applicable safety requirements. All employees are responsible for ensuring a safe working environment. All hazards must be addressed regardless if they have been addressed in this handbook. All contractors working on GSD projects are required to follow OSHA regulations.

GSD safety and health procedures are available for review 24/7 in the Main Capitol Building basement, MB-12.

#### 1. BUILDING ALARMS

In the event of a fire, sound the alarm and/or notify other building occupants immediately. Contractor personnel shall respond appropriately to all alarms by exiting the building immediately and remaining at least 50 feet from the building to allow for emergency response access.

# 2. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Workers must use personal protective equipment, such as:

- Hard hats when overhead, falling or flying hazards exist;
- Safety glasses or face shields for welding, cutting, nailing (including pneumatic), or when working with concrete and/or harmful chemicals;
- Proper shoes or boots to lessen slipping hazards and prevent toe crushing and nail punctures;
- Safety belts and/or harness systems for fall protection.

# 3. HOUSEKEEPING AND ACCESS AROUND SITE

- Keep all walkways and stairways clear of trash/debris and other materials such as tools and supplies to prevent tripping.
- Keep boxes, scrap lumber and other materials picked up and put in a dumpster or trash/debris area to prevent fire and tripping hazards.
- Provide enough light to allow workers to see and to prevent accidents.

# 4. STAIRS AND LADDERS

- All stairs are to be equipped with standard handrails.
- Keep ladders in good condition and free of defects Do not use job made ladders.
- Inspect ladders before use for broken rungs or other defects so falls don't happen. Discard defective ladders.
- Secure ladders at the top and brace or tie off at the bottom to prevent them from slipping and causing falls.

# 5. SCAFFOLDS AND OTHER WORK PLATFORMS

Scaffolding is to be assembled and used according to OSHA regulations.

General scaffolding guidance:

- Provide ladders or stairs to access scaffold and work platforms safely.
- Keep scaffolds and work platforms free of debris. Keep tools and materials as neat as possible on scaffolds and platforms. This will help prevent materials from falling and workers from tripping.
- Erect scaffolds on firm and level foundations.
- Scaffold legs must be placed on firm footing and secured from movement or tipping, especially on dirt or similar surfaces (a good foundation is a must).
- Erecting and dismantling scaffolds must be under the supervision of a Competent Person.
- The competent person must inspect scaffolds before each use.
- Don't use blocks, bricks, or pieces of lumber to level or stabilize the footings.
   Manufactured base plates or "mud sills" made of hardwood or equivalent can be used.

# Planking:

- Fully plank or use manufactured decking to provide a full work platform on scaffolds.
   The platform decking and/or scaffold planks must be scaffold grade and not have any visible defects.
- Extend planks or decking material at least 6' over the edge or cleat them to prevent movement. The work platform or planks must not extend more than 12" beyond the end supports to prevent tipping when stepping or working.
- Be sure that manufactured scaffolds are the proper size and that the end hooks are attached to the scaffold frame.

#### Guardrails:

- Guard scaffold platforms that are more than 10 feet above the ground or floor surface must have a standard guardrail. If guardrails are not practical, use other fall protection devices such as safety belts/harnesses and lanyards.
- Place the top rail approximately 42" above the work platform or planking, with a midrail about half that high at 21".
- Install toe boards when other workers are below the scaffold.

# 6. FALL PROTECTION

OSHA has specific and detailed requirements for fall protection – refer to 29 CFR 1926 Subpart M, 29 CFR 1910, 29 CFR Subpart I. A few of those requirements are listed below:

# **Guarding:**

• Install guardrails around open floors and walls when the fall distance is 4' or more. The top rail must withstand a 200 lb load.

- Construct guardrails with a top rail approximately 42" high with a midrail about half that high at 21".
- Install toe boards when other workers are below the work area.
- Cover floor openings larger than 2x2 (inches) with material to safely support the working load.
- Use other fall protection systems like personal fall arrest systems (harness & lanyard), slide guards, roof anchors or alternative safe work practices when a guardrail system cannot be used. Only wear proper shoes or footwear to lessen slipping hazards.
- Train workers on safe work practices before performing work on foundation walls, roofs, trusses, or where performing exterior wall erections and floor installations.
- Flagging systems can be used, where appropriate. Flagging systems must comply with OSHA guidance.

# 7. EXCAVATION AND TRENCHING

Refer to OSHA regulations for excavation and trenching requirements, along with regulations for walking and working surfaces: 29 CFR 1926 Subpart P, 29 CFR 1910 Subpart D

Some of the Excavation and Trenching requirements are listed below:

- Find the location of all underground utilities by contacting West Virginia 811 before digging. Dial 811 or 800-245-4848.
- Keep workers away from digging equipment and never allow workers in an excavation when equipment is in use.
- Keep workers from getting between equipment in use and other obstacles and machinery that can cause crushing hazards.
- Keep equipment and the excavated dirt back 2 feet from the edge of the excavation.
- Have a competent person conduct daily inspections and correct any hazards before workers enter a trench or excavation.
- Provide workers a way to get into and out of a trench or excavation. Ladders and ramps can be used and must be within 25' of the worker.
- For excavations and utility trenches over 5 feet deep, use shoring (trench boxes), benching, or slope back the sides. Unless soil analysis has been completed, the earth's slope must be at least 1-1/2 horizontal to 1 vertical
- Keep water out of trenches with a pump or drainage system, and inspect the area for soil movement and potential cave-ins.
- Open ditches more than 24 hours or overnight must have fence protection.
- Keep drivers in the cab and workers away when dirt and other debris are being loaded into dump trucks. Workers must never be allowed under any load and must stay clear of the back of vehicles.

# 8. TOOLS AND EQUIPMENT

 Maintain all hand tools and equipment in safe condition and check regularly for defects. Broken or damaged tools and equipment must be removed from the jobsite.

- Use double insulated tools, or ensure the tools are grounded (check for ground plug).
- Equip all power saws (circular, skill, table, etc) with blade guards. Saws must be turned off when unattended. Unplug all power tools when not in use.
- Make sure cords are not damaged. The outer insulation must not be cut or damaged.
- Pneumatic and powder-actuated tools must only be used by trained and experienced personnel. Require proper eye protection for workers.
- Never leave cartridges for pneumatic or powder-actuated tools unattended. Keep equipment in a safe place, according to manufacturer's instructions.

# 9. VEHICLES AND MOBILE EQUIPMENT

- Inform workers verbally and provide training to stay clear of backing and turning vehicles and equipment with rotating cabs.
- Maintain back-up alarms for equipment with limited rear view or use someone to help guide them back.
- Verify experience or provide training to crane and heavy equipment operators.
- Maintain at least 10 foot clearance from overhead power lines when operating equipment.
- Block up the raised bed when inspecting or repairing dump trucks.
- Use a tag line to control materials moved by a crane.

# 10. ELECTRICAL

- Prohibit work on new and existing energized (hot) electrical circuits until all power is shut off and a positive "Lockout/Tagout System" is in place.
- Maintain all electrical tools and equipment in safe condition and check regularly for defects.
- Broken or damaged tools and equipment must be removed from the jobsite.
- Protect all temporary power (including extension cords) with Ground Fault Circuit Interrupters (GFCl's). Plug into a GFCl protected temporary power pole, a GFCl protected generator, or use a GFCl extension cord to protect against shocks.
- Locate and identify overhead electrical power lines. Make sure that ladders, scaffolds, equipment or materials never come within 10 feet of electrical power lines.
- Exterior electrical must be approved (UL, NEMA, etc) for exterior use (no internal junction boxes).

# 11. FIRE PREVENTION

- Provide fire extinguishers near all welding, soldering or other ignition sources.
- Avoid spraying of paint, solvents or other types of flammable materials in rooms with poor ventilation. Build up of fumes and vapors can cause explosions or fires.
- Store gasoline and other flammable materials in a safety can outdoors or in an approved storage facility. (Metal cans with self-sealing lids).

# 12. CHEMICAL HAZARDS

All hazardous chemicals present in the workplace must have an up-to-date Material Safety Data Sheet (MSDS). All contractors shall maintain MSDS for chemicals used or stored at GSD facilities. All warnings and directions for use must be followed.

## 13. CONFINED SPACES

By definition, a **confined space**:

- Is large enough for an employee to enter fully and perform assigned work;
- Is not designed for continuous occupancy by the employee; and
- Has a limited or restricted means of entry or exit.

These spaces may include underground vaults, tanks, storage bins, pits and diked areas, vessels, silos and other similar areas.

By definition, a **permit-required confined space** has one or more of these characteristics:

- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material with the potential to engulf someone who enters the space;
- Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- Contains any other recognized serious safety or health hazards.

Entry into confined spaces without an evaluation is forbidden. Entry into permitrequired confined spaces requires compliance with all OSHA requirements. Entry into non-permit spaces will require an evaluation by GSD Safety to confirm that conditions remain non-permit required.

Contractors that perform confined space entry activities are required to comply with OSHA regulations. GSD will not provide confined space rescue equipment.

#### 14. LOCK-OUT/TAG-OUT

Before working on, repairing, adjusting or replacing equipment and machinery, all appropriate safety procedures, including lockout/tagout, must be utilized to place the machinery or equipment in a neutral or zero mechanical state.

Outside contractors are expected to have knowledge of lock-out/tag-out requirements.

# Contractor Acknowledgement:

I, the undersigned, have read, reviewed and acknowledge my understanding of the General Services Division safety requirements, as set forth in this handbook. I am also aware that all applicable rules and regulations are to be followed, regardless of whether they are specifically mentioned in this handbook.

Contractor Representative (Print Name):			
Contractor Representative Signature:	Date:		

This signed acknowledgement must be signed and returned to the GSD Safety Section prior to start of project work.

#### SECTION 016000 - PRODUCT REQUIREMENTS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

## 1.2 SUMMARY

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

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent:
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Engineer-Approved Comparable Product: A product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those specified:
    - a. If no specific manufacturer is listed for an Engineer-Approved Equivalent product, then any vendor may make a pre-bid submission request for the required Engineer approval.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance,

- and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.
- C. Substitutions (post-award): 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 to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.
- B. Substitution Requests (post-award): Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles:
  - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product, fabrication or installation cannot be provided, if applicable.
  - 2. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
  - 3. Detailed comparison of significant qualities of proposed substitution 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.
  - 4. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - 5. Samples, where applicable or requested.
  - 6. Certificates and qualification data, where applicable or requested.
  - 7. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and Owners.
  - 8. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - 9. Research reports evidencing compliance with building code in effect for Project.
  - 10. Detailed comparison of Contractor's construction schedule using proposed substitution 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.
- 11. Cost information, including a proposal of change, if any, in the Contract Sum.
- 12. 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.
- 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.
- Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven days of receipt of a request for substitution.
- 15. For Pre-Bid Substitutions, an addendum will be issued to respond to technical questions submitted to request substitutions, either verifying acceptance of the proposed substitute if sufficiently documented in the submitted question to verify compliance with all specifications or denial of the requested substitution, either for insufficient documentation or for failure to comply with all specifications. No other substitution will be considered after bid date unless the Contractor can document Substitutions for Cause or Substitutions for Convenience that may offer advantage the Owner:
  - Forms of Acceptance: Addendum, Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
- 16. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options:
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.
- B. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.
- C. Statement of Applicability: The supplier of products specified and intended to be used in the project is to provide a written certification in the form of a "Statement of Applicability" that they have reviewed the proposed application of the product specified and found it to be suitable and appropriate. If product specified is judged not to be appropriate, supplier to notify in writing, not less than 14 days prior to bid, if exceptions or adjustments are necessary. Failure to note exceptions or produce the Statement of Applicability will indicate supplier's acceptance of the product for its intended use.

# 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

# B. Delivery and Handling:

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

# C. Storage:

- Store products to allow for inspection and measurement of quantity or counting of units
- 2. Store materials in a manner that will not endanger Project structure.
- 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- 4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
- 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- 6. Protect stored products from damage and liquids from freezing.
- 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

#### 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents:
  - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a specific product and endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution:

- 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
- 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

#### PART 2 - PRODUCTS

#### 2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents:
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  - 4. Where products are accompanied by term "as selected," Engineer will make selection.
  - 5. Where products are accompanied by the term "match sample," sample to be matched to Engineer's sample.
  - 6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
  - 7. For products specified by name and accompanied by the term "or equal", "or approved equal", or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

#### B. Product Selection Procedures:

- 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
- 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
- 3. Products:
  - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
- 4. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

# 5. Manufacturers:

- a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
- 6. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
- 7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- 8. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

# 2.2 SUBSTITUTIONS (post-award)

- A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals:
  - Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
    - Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 2. Substitution request is fully documented and properly submitted.
  - 3. Requested substitution will not adversely affect Contractor's construction schedule.
  - 4. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 5. Requested substitution is compatible with other portions of the Work.
  - 6. Requested substitution has been coordinated with other portions of the Work.
  - 7. Requested substitution provides specified warranty.
  - 8. 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.
  - 9. Problems exist with availability of specified product or suitability of specified product.

- 10. Substitutions for Convenience: Engineer will consider requests for substitution if received within 90 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer:
- 11. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer 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 Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
- 12. Other requirements listed in the paragraph above under "Substitutions for Cause."

#### 2.3 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
  - 1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
- B. Evidence that proposed product provides specified warranty.
- C. List of similar installations for completed projects with project names and addresses and names of Engineers and owners, if requested.
- D. Samples, if requested.

PART 3 - EXECUTION (Not Used)

**END OF SECTION 016000** 

#### SECTION 017300 - EXECUTION REQUIREMENTS

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
  - 9. Correction of the Work.
  - 10. Mold investigation and remediation services for the following:
    - a. Services applicable to Correction of the Work.
    - b. Owner-required "free-of-mold" construction certification services.
  - 11. Related Sections:
    - a. Division 1 Section "Selective Demolition" for demolition and removal of selected portions of the building.
  - Division 1 Section "Closeout Procedures" for submitting Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### 1.3 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements:
  - 1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions before proceeding.

- Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
- 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.
- Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, which results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.
- 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

#### 1.4 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

#### PART 2 - PRODUCTS

#### 2.1 MATERIALS

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

#### PART 3 - EXECUTION

# 3.1 EXAMINATION

A. Existing Conditions: Existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework,

investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work:

- 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
- 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations:
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Engineer per requirements in Division 1 Section "Project Management and Coordination."

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

#### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices:
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

#### 3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations:
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or

- control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
- 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark:
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed.
  - 4. Restore marked construction to its original condition.

#### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated:
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 7'-6" in spaces without a suspended ceiling.
  - 5. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- B. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading excess of that expected during normal conditions of occupancy.
- D. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.
- E. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- F. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions:
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.

- 2. Allow for building movement, including thermal expansion and contraction.
- G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

# 3.6 OWNER-INSTALLED PRODUCTS (IF APPLICABLE)

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel:
  - Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Pre-installation Conferences: Include Owner's construction personnel at pre-installation conferences covering portions of the Work that are to receive Owner's work. Attend pre-installation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

#### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully:
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80°F.
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
  - 4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work:
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 1 Section "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of construction, completed or in progress, is subject to harmful, dangerous, damaging or otherwise deleterious exposure during the construction period. Ensure that wetness, moisture and humidity are controlled so that conditions conducive to the formation of mold are not created during the entire construction period.

#### 3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Division 1 Section "Quality Requirements."

#### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

#### 3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction or components that do not operate properly. Restore damaged substrates and finishes. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair:
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

#### SECTION 017310 - CUTTING AND PATCHING

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include:
  - 1. Division 1 Section "Selective Demolition".

#### 1.3 DEFINITIONS

- A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

#### 1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
- B. Products: List products to be used and firms or entities that will perform the Work.
- C. Dates: Indicate when cutting and patching will be performed.

- D. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
- E. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
- F. Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

#### 1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio:
  - 1. This includes, but is not limited to, masonry walls, structural beams, joists and deck, precast concrete plank, and cast-in-place concrete decks or slabs.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety:
  - 1. Primary operational systems and equipment.
  - 2. Air or smoke barriers.
  - 3. Fire-protection systems.
  - 4. Control systems.
  - 5. Communication systems.
  - 6. Conveying systems.
  - 7. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, results in reducing their capacity to perform as intended, or results in increased maintenance or decreased operational life or safety:
  - 1. Water, moisture, or vapor barriers.
  - 2. Membranes and flashings.
  - 3. Exterior curtain-wall construction.
  - 4. Equipment supports.
  - 5. Piping, ductwork, vessels, and equipment.
  - 6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

- E. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm:
  - 1. Processed concrete finishes.
  - 2. Stonework and stone masonry.
  - 3. Ornamental metal.
  - 4. Matched-veneer woodwork.
  - 5. Preformed metal panels.
  - 6. Roofing.
  - 7. Firestopping.
  - 8. Window wall system.
  - 9. Stucco and ornamental plaster.
  - 10. Terrazzo.
  - 11. Finished wood flooring.
  - 12. Fluid-applied flooring.
  - 13. Aggregate wall coating.
  - 14. Wall covering.
  - 15. HVAC enclosures, cabinets, or covers.
- F. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- G. When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from the Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut structural members without prior written approval of Engineer. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio:
- H. This includes, but is not limited to, masonry walls, structural beams, joists and deck, precast concrete plank, and cast-in-place concrete decks or slabs.

# 1.6 CUTTING AND PATCHING ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
  - 1. Primary operational systems and equipment.
  - 2. Air or smoke barriers.
  - 3. Fire-suppression systems.
  - 4. Mechanical systems piping and ducts.
  - 5. Control systems.
  - 6. Communication systems.

- 7. Electrical wiring systems.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
  - 1. Water, moisture, or vapor barriers.
  - 2. Membranes and flashings.
  - 3. Equipment supports.
  - 4. Piping, ductwork, vessels, and equipment.
  - 5. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

# 1.7 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

#### PART 2 - PRODUCTS

# 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections of these Specifications.
- B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, fully use materials that visually match existing adjacent surfaces:
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed:
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.
- C. Before construction, verify the location and points of connection of utility services.
- D. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning site work, investigate and verify the existence and location of underground utilities and other construction affecting the Work:
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
- E. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- F. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations:
  - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- G. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
- H. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
- I. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.
- E. Temporary Support: Provide temporary support of Work to be cut.
- F. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- G. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- H. Existing Services: Where existing services are required to be removed, relocated or abandoned, bypass such services before cutting to minimize interruption of services to occupied areas.

#### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay:
  - 1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations:
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size

required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

- C. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
- D. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
- E. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- F. Proceed with patching after construction operations requiring cutting are complete.
- G. Patching: Patch construction by filling, repairing, refinishing, sealing, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications:
- H. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- I. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
- J. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance:
  - Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
- K. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an evenplane surface of uniform appearance.
- L. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
- 3.4 OWNER WORK (If Applicable)
  - A. Site Access: Provide access to Project site for Owner's construction forces.
  - B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

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END OF SECTION 017310

#### SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Disposing of nonhazardous construction waste.

# B. Related Requirements:

1. Division 01 Section "Temporary Facilities and Controls" for environmental-protection measures during construction.

#### 1.3 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

#### 1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

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- 1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
- 2. Review requirements for documenting quantities of each type of waste and its disposition.
- 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
- 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.

# PART 2 - PRODUCTS (NOT USED)

#### PART 3 - EXECUTION

#### 3.1 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction:
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

#### **END OF SECTION 017419**

### SECTION 017700 - CLOSEOUT PROCEDURES

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 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 Sections:

- 1. Division 1 Section "Execution Requirements".
- 2. Division 1 Section "Project Record Documents".
- 3. Division 1 Section "Operation and Maintenance Data".

## 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Provide the following before requesting inspection for determining date of Substantial Completion:
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

- 5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
- 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
- 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
- 8. Complete startup and testing of systems.
- 9. Submit test/adjust/balance records.
- 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
- 11. Advise Owner of changeover in heat and other utilities.
- 12. Submit changeover information related to Owner's occupancy, use, operation and maintenance.
- 13. Complete final cleaning requirements, including touchup painting.
- 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Provide Consent of Surety for Reduction in or Partial Release of Retainage (AIA Document G707-A) letter advising Owner on coordination of shifting insurance coverages including Proof of Extended Insurance Coverages as required. Advise Owner of Pending Insurance Changeover Requirements.
- C. Provide Test, Adjust, and Balance Reports, Meter Readings, Maintenance Instructions, Startup Reports, or similar Information necessary for the Owner's Occupancy and Use of the Facilities.
- D. Complete demonstration and training requirements.
- E. Evidence of Cleaning Requirements. Patch and paint all areas disturbed by demolition and new construction as required to match existing adjacent finishes.
- F. Provide Project Record Documents including, drawings labeled "Project Record Drawings", Project Manual and Warranties, Operations and Maintenance Manuals, Record Submittals, Comprehensive List of Sub-Contractors, Suppliers, and Warranty Contact Personnel.
- G. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer 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 Engineer, that must be completed or corrected before certificate will be issued:
  - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  - 2. Results of completed inspection will form the basis of requirements for final completion.

H. Arrange for each Installer of Equipment that requires Operation and Maintenance to provide Instruction to Owner's Personnel. See Section "Demonstration and Training" under Closeout Procedures.

### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete and submit the following:
  - 1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures." Documentation that payment or satisfactions of all applicable State and Local Tax Obligations have been paid. Consent of Surety Company for Final Payment.
  - Submit certified copies of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  - 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  - 4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.
  - 5. Release of Liens from ALL Sub-Contractors, Suppliers, Consultants, etc.
  - 6. Warranties and Maintenance Agreements Record Drawings and Record Specifications.
  - 7. Evidence of Completion of Project Closeout Requirements.
  - 8. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  - 9. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  - 10. AIA Document G707, "Consent of Surety to Final Payment."
  - 11. Evidence that claims have been settled.
  - 12. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of substantial completion or when Owner took possession of and assumed responsibility for corresponding elements of the work.
  - 13. Final Liquidated Damages Settlement Statement.
  - 14. Evidence of Final Cleaning Completion.
  - 15. Submit Pest-Control Final Inspection Report and Warranty.
  - 16. Insurance Certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  - 17. Updated Final Statement, accounting for final changes to the contract sum.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer 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. Reinspection: Request reinspection when the work identified in previous inspections as incomplete is completed or corrected.

# 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- 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 proceeding from lowest floor to highest floor.
  - 2. Organize items applying to each space by major element, including categories for ceiling, 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 Engineer.
    - d. Name of Contractor.
    - e. Page number.

## 1.6 DEMONSTRATION AND TRAINING

- A. Provide Owner's personnel with a sign-off sheet after demonstration and training is completed and enclose in O&M Manuals. Sign-off sheet to include date completed, printed personnel name, signature of personnel, job title of personnel, project name, and check box of the below requirements.
- B. Instruction: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system:
  - 1. Provide instructors experienced in operation and maintenance procedures.
  - 2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
  - 3. Schedule training with Owner with at least seven days' advance notice.
  - 4. Coordinate instructors, including providing notification of dates, times, length of instruction, and course content.
- C. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for the following:
  - 1. System design and operational philosophy.
  - 2. Review of documentation.
  - 3. Identification systems.
  - 4. Startup and shutdown.
  - 5. Noise and vibration adjustments.
  - 6. Lubricants and fuels.
  - 7. Control sequences.
  - 8. Hazards.
  - 9. Emergency operations and safety procedures.
  - 10. Troubleshooting.
  - 11. Repair.

- 12. Maintenance manuals.
- 13. Warranties and bonds.
- 14. Spare parts, tools, and materials.

### 1.7 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual:
  - 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" x 11" paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals:
  - 1. Clear plastic sleeve on front, back, and spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - 2. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross reference other binders, if necessary, to provide essential information for proper operation or maintenance of equipment or system.
  - 3. Maximum binder width is 4".
  - 4. Binder to be "D" ring with ring locks to keep aligned.
  - 5. Dividers: Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  - 6. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

### 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. General: 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 portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
  - 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.
  - 3. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - 4. Sweep concrete floors broom clean in unoccupied spaces.
  - 5. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - 6. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - 7. Remove labels that are not permanent.

- 8. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration:
- 9. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
- 10. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- 11. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
- 12. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- 13. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- 14. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
- 15. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
- 16. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Division 1.

### 3.2 CONTRACT CLOSEOUT CHECKLIST

- A. Prior to request for final payment, and within forty-five (45) days of Completion submit completed Checklist to Engineer.
- B. For each item included in Checklist, furnish initials of person responsible for confirming completion of the item, and the date the item was completed.

**END OF SECTION 017700** 

#### SECTION 017823 - OPERATION AND MAINTENANCE DATA

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.

## 1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section:
  - 1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.
- B. Initial Manual Submittal: Submit draft copy of each manual at least 15 days before commencing demonstration and training. Engineer will comment on whether general scope and content of manual are acceptable:
  - Submit one (1) electronic copy in PDF format on DVD or Thumb Drive including a complete O&M directory/table of contents. Engineer will review and return with comments.
- 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. Engineer will return copy with comments, if any:

- 1. Submit minimum of three (3) hard copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves:
  - a. Provide three (3) digitized copies on DVD in electronic format (PDF).
- D. Include shop drawings, product data and operation & maintenance data as required in individual Specification Sections and as follows:
  - 1. Cover Sheet with project name and pertinent information.
  - 2. Table of Contents based on the Table of Contents in the Project Manual.
  - 3. Include in Division One (1) the following:
    - a. Copies of Closeout Documents.
    - b. Copies of Project Meeting minute.
    - c. Copies of Engineer's Observation Reports.
    - d. Copies of Building Permit from the City if required.
    - e. Copies of Occupancy Permit and Fire Safety Inspection Report, issued by the West Virginia State Fire Marshal's Office.
    - f. Copies of the Original Warranties.
    - g. List of all finishes, such as:
      - 1) Paint manufacturer and color.
      - 2) Floor tile manufacturer and name.
      - 3) Ceiling tile manufacturer ad name.
      - 4) Any other color selection or special finish items.
    - h. List in table form of Project Owner, Engineer, Contractor, Sub-Contractors, Suppliers, etc.:
      - 1) Description.
      - 2) Firm Name.
      - 3) Address.
      - 4) Office Phone Number.
      - 5) Office Fax Number.
      - 6) Firm's Web Site Address (if applicable).
      - 7) Representative's Name.
      - 8) Representative's Cell Phone Number (if applicable).
      - 9) Representative's E-mail Address (if applicable).
    - i. Operation Data:
      - 1) Emergency instructions and procedures.
      - 2) System, subsystem, and equipment descriptions, including operating standards.
      - 3) Operating procedures, including startup, shutdown, seasonal and weekend operations.
      - 4) Description of controls and sequence of operations.
      - 5) Piping diagrams.
      - 6) Wiring diagrams.
      - 7) Fixture lamping schedule.
      - 8) List of inspection procedures.
    - j. Maintenance Data:
      - 1) Manufacturer's information, including list of spare parts.
      - 2) Name, address and telephone number of Installer or Supplier.
      - 3) Maintenance procedures.
      - Maintenance and service schedules for preventive and routine maintenance.
      - 5) Maintenance record forms.

- 6) Source of spare parts and maintenance materials.
- 7) Copies of maintenance service agreements.
- 8) Copies of warranties and bonds.

### PART 2 - PRODUCTS

# 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.
  - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- 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."

# 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: 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.
  - 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 Construction Manager.

- 7. Name and contact information for Engineer.
- 8. Name and contact information for Commissioning Agent.
- 9. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
- 10. 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:
  - If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- 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. 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" x 11" paper; with clear plastic sleeve on front, back, and spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets:
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross- reference other binders, if necessary, to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
    - c. Maximum binder size is 4".
    - d. Binder to be "D" ring with ring locks to keep aligned.
  - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
  - 4. Supplementary Text: Prepared on 8-1/2: x 11" white bond paper.
  - 5. 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.

### 2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
  - 4. 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:
    - a. Fire.
    - b. Flood.
    - c. Gas leak.
  - 5. Water leak.
  - 6. Power failure.
  - 7. Water outage.
  - 8. System, subsystem, or equipment failure.
  - 9. Chemical release or spill.
  - 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.
  - 11. Emergency Procedures: Include the following, as applicable:
    - a. Instructions on stopping.
  - 12. Shutdown instructions for each type of emergency.
  - 13. Operating instructions for conditions outside normal operating limits.
  - 14. Required sequences for electric or electronic systems.
  - 15. Special operating instructions and procedures.

# 2.4 OPERATION MANUALS

- A. 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 is 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.
  - 11. Descriptions: Include the following:
    - a. Product name and model number. Use designations for products indicated on Contract Documents.
  - 12. Manufacturer's name.
  - 13. Equipment identification with serial number of each component.

- 14. Equipment function.
- 15. Operating characteristics.
- 16. Limiting conditions.
- 17. Performance curves.
- 18. Engineering data and tests.
- 19. Complete nomenclature and number of replacement parts.
- 20. Operating Procedures: Include the following, as applicable:
  - Startup procedures.
- 21. Equipment or system break-in procedures.
- 22. Routine and normal operating instructions.
- 23. Regulation and control procedures.
- 24. Instructions on stopping.
- 25. Normal shutdown instructions.
- 26. Seasonal and weekend operating instructions.
- 27. Required sequences for electric or electronic systems.
- 28. Special operating instructions and procedures.
- 29. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.
- 30. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

- A. 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.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference
- C. Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. 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.
- E. 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.
- F. Repair Materials and Sources: Include lists of materials and local sources of 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.
  - 2. Identify each binder on front and spine, with Typed, Bold-Faced Font with the Title "PRODUCT MAINTENANCE MANUAL," Project title or name, name of Contractor and subject matter of contents. Indicate volume number for multiple-volume sets.

### 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. 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 warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 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.
  - 5. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
    - a. Test and inspection instructions.
  - 6. Troubleshooting guide.
  - 7. Precautions against improper maintenance.
  - 8. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 9. Aligning, adjusting, and checking instructions.
  - 10. Demonstration and training video recording, if available.
- D. 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:

- 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
- 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- E. 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.
- F. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- 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.
  - 2. Identify each binder on front and spine, with Typed, Bold-Faced Font with the Title "SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL," Project title or name, name of Contractor and subject matter of contents. Indicate volume number for multiple-volume sets.

## 2.7 WARRANTY MANUALS

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Identify each binder on front and spine, with Typed, Bold-Faced Font with the Title "WARRANTY MANUAL," Project title or name, name of Contractor and subject matter of contents. Indicate volume number for multiple-volume sets.
- D. Provide a Typed description of the product or installation, including the name of the product and the name, address, and telephone number of the Installer.
- E. Provide additional copies as required of each warranty to be included in the Operation and Maintenance Manuals.

## 2.8 OPERATING INSTRUCTIONS TO OWNER:

- A. Provide Owner's representative(s), the following:
  - 1. Instruction in proper operation and maintenance of equipment along with an instructional DVD showing proper operation and maintenance of equipment.
  - 2. A review of the following items:
    - a. Maintenance manuals.

- b. Record documents.
- c. Spare parts and materials.
- d. Lubricants and fuels.
- e. Identification systems.
- f. Control sequences.
- g. Hazards.
- h Warranties and bonds
- i. Maintenance agreements and similar continuing commitments.
- 3. Demonstrate the following procedures:
  - a. Emergency operations and safety procedures.
  - b. Start-up and shutdown.
  - c. Economy and efficiency adjustments.
  - d. Vibration and noise adjustments.
  - e. Effective energy utilization.

## 2.9 DEMONSTRATION AND TRAINING

A. Provide Owner's Personnel with a Sign-Off Sheet after Demonstration and Training is Completed and Enclose in O&M Manuals. Sign-Off Sheet to Include Date Completed, Printed Personnel Name, Signature of Personnel, Job Title of Personnel, Project Name, etc.

### PART 3 - EXECUTION

# 3.1 MANUAL PREPARATION

- 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. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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:

- 1. 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.
- E. 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. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Division 1 Section "Project Record Documents."
- F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

### SECTION 017839 - PROJECT RECORD DOCUMENTS

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

### 1.2 SUMMARY

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

### B. Related Sections:

- 1. Division 1 Section "Execution Requirements".
- 2. Division 1 Section "Closeout Procedures" for general closeout procedures.
- 3. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.

# 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Submit copies as follows:
  - 1. Initial Submittal: Submit one (1) PDF electronic copy for Engineer. Engineer will indicate whether general scope of changes, additional information recorded, and quality of drawings are acceptable. Engineer will return electronic PDF for organizing into sets, printing, binding, and final submittal.
  - 2. Final Submittal: Submit minimum of three (3) paper copies of marked-up record prints for Owner and one (1) PDF electronic copy for Engineer. Print each Drawing, whether changes and additional information were recorded. Provide three (3) digitized copies on DVD in non-producible electronic format (PDF):
    - a. Identify and Date Record Drawings Include the Designation "PROJECT RECORD DRAWINGS" in a Prominent Location.

- 3. Record Specifications: Submit copies of Project's Specifications, including addenda and contract modifications.
- B. Record Product Data: Submit minimum of three (3) paper copies of each submittal. Provide three (3) digitized copies on DVD in non-producible electronic format (PDF):
  - 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:
    - a. Identify and Date Product Data Include the Designation "PROJECT RECORD PRODUCT DATA" in a Prominent Location.
  - 2. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

### PART 2 - PRODUCTS

## 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one (1) set of marked-up paper copies of the Contract Drawings and shop drawings. Provide three (3) digitized copies on DVD in non-producible electronic format (PDF):
  - 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.
  - 2. Accurately record information in an acceptable drawing technique.
  - 3. Record data as soon as possible after obtaining it.
  - 4. Record and check the markup before enclosing concealed installations.
  - 5. Cross-reference record prints to corresponding archive photographic documentation.
  - 6. Content: Types of items requiring marking include, but are not limited to, the following:
    - Dimensional changes to Drawings.
  - 7. Revisions to details shown on Drawings.
  - 8. Depths of foundations below first floor.
  - 9. Locations and depths of underground utilities.
  - 10. Revisions to routing of piping and conduits.
  - 11. Revisions to electrical circuitry.
  - 12. Actual equipment locations.
  - 13. Duct size and routing.
  - 14. Locations of concealed internal utilities.
  - 15. Changes made by Change Order or Construction Change Directive.
  - 16. Changes made following Engineer's written orders.
  - 17. Details not on the original Contract Drawings.
  - 18. Field records for variable and concealed conditions.
  - 19. Record information on the Work that is shown only schematically.

- 20. Mark Contract Drawings and shop drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
- 21. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 22. Mark important additional information that was either shown schematically or omitted from original Drawings.
- 23. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Engineer determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation:
  - 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  - 2. Consult Engineer for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location:
  - 1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  - 2. Identification: As follows:
    - a. Project name.
  - 3. Date.
  - 4. Designation "PROJECT RECORD DRAWINGS."
  - 5. Name of Engineer.
  - 6. Name of Contractor.

### 2.2 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. Format: Submit record Specifications as marked-up paper copy. Provide three (3) digitized copies on DVD in non-producible electronic format (PDF).

# 2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal:

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- 1. Give 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.
- 4. Format: Submit record Product Data as paper copy. Provide three (3) digitized copies on DVD in non-producible electronic format (PDF):
- 5. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

# PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples 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 Engineer's reference during normal working hours.

END OF SECTION 017839

### SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 WORK INCLUDED

- A. Commissioning requirements common to all Sections
- B. Systems and equipment start-up and functional performance testing
- C. Validation of proper and thorough installation of systems and equipment
- D. Equipment performance verification
- E. Documentation of tests, procedures, and installations
- F. Coordination and requirements of training events
- G. Management of Record Construction Documentation
- H. Sequencing

### 1.3 GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner's operational needs; that the installation is adequately documented; and that the Owner's personnel are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols to advance the building systems from installation to full dynamic operation and optimization.
- B. Commissioning Authority (CxA) shall work with the Contractor and the Design Engineer to direct and oversee the Commissioning process and perform functional performance testing.

C. This Section and other Sections of the specification details the Contractor's responsibilities relative to the Commissioning process.

#### 1.4 SCOPE

- A. This Section covers elements, requirements, procedures, and protocols common across all Divisions of the work. Requirements specific to individual Sections are generally specified in the technical specification as well as a dedicated Section for each of Division 23.
- B. Specific systems to be commissioned are indicated in the following Divisions of the Specification:
  - 1. Divisions 01: Conformance to the following provisions of the Commissioning requirements is required under Division 01 and this Section:
    - a. Equipment and Systems Training as required by individual sections.
    - b. Record Document preparation and maintenance.
  - 2. Division 01 Functional Performance Testing: Requirements for Functional Performance Testing are specified in Section 019114.
  - 3. Division 01 Commissioning Plan: Requirements for the Commissioning Plan are specified in Section 019115 with preliminary Pre-function and Functional Performance Testing (FPT) documentation.
  - 4. Division 23 HVAC and ATC: Requirements for Commissioning are specified in Section 230800 as well as in individual Div. 23 Sections.
- C. The following systems are to be commissioned:
  - 1. HVAC
    - a. Ductwork
    - b. Supply Fan
    - c. Boilers
    - d. Hydronic pumps and accessories
    - e. Automatic Temperature Controls
    - f. Testing, Adjusting and Balancing
    - g. Unit Heaters
    - h. CO Monitoring
  - 2. Electrical
    - a. Fire Alarm System(s) limited to Interface Items with HVAC
    - b. VFD's associated with HVAC

# 1.5 RELATED WORK AND DOCUMENTS

- A. Commissioning Plan: The Commissioning Plan outlines the commissioning process beyond the construction specification.
- B. Individual Division 1 Sections: References requirements for Submittals, Contractor notifications, starting and adjusting, quality, O&M and building manuals, and System Certifications.

- C. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- D. Section 019114 Functional Performance Testing Procedures: Outlines the generic functional testing procedures required.
- E. Section 019115 Commissioning Plan. Details preliminary Pre-function and Functional Performance Testing (FPT) documentation.
- F. Section 230800 HVAC Systems Commissioning: Details the commissioning procedures specific to HVAC (Div. 23) work.

## 1.6 DEFINITIONS AND ABBREVIATIONS

- A. Acceptance Phase: This is the phase of the project when the facility and its systems and equipment are inspected, tested, verified, and documented; and when most of the Functional Performance Testing and some final training occur. This will generally occur after the Construction Phase is complete (start-up and checks have been accomplished). The Acceptance Phase typically begins with certification by the contractor that the systems have been started up in accordance with the approved protocols and the submission of the documentation of that start-up. The Acceptance Phase ends with the successful completion of all functional performance testing and sign off by the Commissioning Agent as well as the Owner.
- B. Action Item (AI): Any issue that requires a response, completion, corrective or additional work, or any other action. Examples include a Request for Information (RFI), a work directive, a clarification request, a to-do item, an identified deficiency, or any other like item. Action Items must be categorized as appropriate.
- C. Action List: This is a list that is maintained and updated by the CxA that includes all Action Items that relate to Commissioning activities.
- D. A/E: General reference to the Architect/Engineer lead-design entity.
- E. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers.
- F. Automatic Temperature Controls Contractor (ATC): Contractor responsible for providing the Building Automation System and automatic temperature controls specified in fill in for specific project.
- G. Building Automation System (BAS): The computer-based control or automation system. May also be referred to as the FMS.
- H. ComIT: Commissioning Information Tool, a software tool used for collaborative commissioning information management.
- I. Commissioning (Cx): The process of ensuring that all building systems perform interactively according to the design intent, the systems are efficient and cost effective and meet the Owner's operational needs.

- J. Commissioning Authority (CxA): Sometimes also referred to as the Commissioning Agent, the Party retained by the Owner who will oversee the Commissioning process, develop and stipulate many of the Commissioning requirements, manage the Commissioning process, and ensure and validate that systems and equipment are designed, installed and tested to meet the Owner's requirements.
- K. Commissioning Coordinator (CxC): This refers to the Individual within each of the various Parties that is designated the (POC) for that Party relative to Commissioning activities.
- L. Commissioning Portal: This is an internet hub for the collaboration on Commissioning information. This portal will act as a hub for posting electronic information.
- M. Commissioning Specifications ('Commissioning Specs): Includes separate Commissioning specification sections and Commissioning-related subsections of other specifications. All Contractor requirements relating to Commissioning should be conveyed within the Commissioning Specs.
- N. Commissioning Team (CxT): The group of Parties involved in the commissioning process for any given system. The Commissioning Team will include a core group involved with all systems. This core group will typically include the CxA, the Owner's Commissioning Coordinator (O/O-CxC)] and the GC's Commissioning Coordinator (GC-CxC). On any given system, the Commissioning Team will also include the Commissioning Coordinator for the Contractor(s) responsible for the system or equipment.
- O. Contractor: As used herein, 'Contractor' is a general reference to the installing Party and can therefore refer to the GC, subcontractors, or vendors as inferred by its usage.
- P. Construction Phase: Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. Contractor and subcontractors complete the installation, complete start-up documentation, submit O&M information, establish trends, and perform any other applicable requirements to get systems started. Contractor and Vendors may also conduct equipment specific training. The Construction Phase will generally end upon completed start-up and TAB of systems and equipment.
- Q. Contract Documents: The documents governing the responsibilities and relationships between Parties involved in the design and construction of this project including (but not necessarily limited to):
  - 1. Agreements/Contracts;
  - 2. Construction Plans and Drawings;
  - 3. Specifications;
  - 4. Addenda:
  - 5. Change Orders;
  - 6. Commissioning Plan
- R. Construction Documents: Refers generally to the Contract Documents that dictate the details of the installation (all but item a. above).

- S. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design documents)
- T. Electrical Contractor (EC): Contractor generally responsible for Div. 26 work
- U. Facility Management System (FMS): Alternate reference to the computer based control or automation system. May also be referred to as automatic temperature control (ATC) system, direct digital control (DDC) system, building automation system (BAS), building management system (BMS), building management and control system (BMCS), digital control system (DCS), Energy Management System (EMS), Energy Management and Control System (EMCS) or System Control And Data Acquisition (SCADA) System.
- V. Factory Authorized Representative: An individual fully trained on the equipment and certified by the manufacturer to perform the respective task.
- W. Factory Testing: Testing of equipment off-site at the manufacturer's facility may be witnessed by the members of the project team.
- X. Field Testing by Factory Authorized Representative: On site testing of equipment conducted by a factory authorized representative.
- Y. Fire Alarm Contractor (FAC): Contractor generally responsible for the fire alarm system installation.
- Z. Formal Hand Off Meeting: This is a quality control exercise in which all contractors responsible for completing the installation and start-up of a system or equipment, along with the CxA, Owner and GC, meet to validate that the system or equipment is completed per the contract documents and ready for functional testing, and that all the start-up, verification, nameplate data, prefunctional checklists and testing documentation is complete and accurate to a functional state of completion. GC shall organize and lead the process in all cases.
- AA. Functional Acceptance: A milestone that marks the completion of the Acceptance Phase and successful completion of the FPTs by the CxA.
- BB. Functional Performance Testing (FPT): The detailed and thorough testing of the building systems and the components and equipment making up those systems. References made to FPT throughout the documents are generally inclusive of ISFPT unless specifically indicated otherwise.
- CC. General Contractor (GC): The party acting as the primary coordinator of all the major subcontractors (MC, EC, TAB, ATC, etc. as applicable).
- DD. IAQ: Indoor Air Quality
- EE. Interactive System Functional Performance Testing (ISFPT): The detailed and thorough testing of the interactions of various systems in the building. ISFPTs are considered a subset of the overall concept of FPT and therefore references made to FPT generally will include ISFPTs unless specifically indicated otherwise.

- FF. Manufacturer's Representative: Either an individual in direct employ of the manufacturer of the applicable system, or an individual who is certified by that manufacturer to perform the applicable work for which the reference is made. This is synonymous with Factory Authorized Representative
- GG. Mechanical Contractor (MC): Contractor generally responsible for Division 23 work
- HH. O&M Documentation: The foundation of O&M Documentation is manufacturer's literature (including 'O&M Manuals', parts lists, troubleshooting guides, etc.) as well as Contractor-developed instructions for start-up and shut-down, sequences, and other installation-specific information.
- II. O&M Manuals: This term shall be reserved for referencing manufacturer-published O&M documents, which generally has no information specific to the specific facility. Specifications should strive for this information to be submitted in electronic form whenever possible.
- JJ. Opposite Season: The season opposite that when the majority of the testing occurs.
- KK. Owner/Operator (O/O): This is a combined reference to the both the Owner and the Operators of the facility
- LL. Party: Entity legally responsible for portion of work.
- MM. Point of Contact (POC): General reference to the key individual within each Party.
- NN. Pre-Test: Preliminary testing accomplished to verify system functionality prior to placing the system/equipment into preliminary service.
- OO. Project Phases: Phases of the project include the Construction Phase, Acceptance Phase, and Warranty Phase
- PP. Project Officer (PO): Individual or entity directly employed by the Owner who is in charge of the design and construction coordination for the project.
- QQ. RFI: Request for Information
- RR. Scheduled Outage: A period of time, scheduled by Owner, in which the system is out-of-service or not to be used by occupants.
- SS. Start-Up: Refers to the quality control process whereby the Contractor verifies the proper installation of a device or piece of equipment, executes the manufacturer's starting procedures, completes the Start-Up Checklist, energizes the device, verifies that it is in proper working order and ready for dynamic testing, and completes the Start-Up Tests.
- TT. Start-Up Checklist Item: A list of items to inspect to verify proper installation of equipment or systems by the Contractor. Checklist items simply require a 'Yes/No' or 'OK/Not' response. These include primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension checked, oil levels OK, labels affixed, gauges in place, sensors calibrated, etc.). Start-Up Checklist items are one component of the Start-Up Procedures (Start-Up Tests being the other).

- UU. Start-Up Procedures: Refers to the combination of Start-Up Checklists and Start-Up Tests. Start-Up Procedures are typically performed by the Contractor with or without a formal Commissioning process. The Contractor documents the start-up process by completing and submitting the Start-Up Procedures. Start-up procedures may be a combination of those prepared by the CxA, those performed included in the contractor's quality assurance process, and those required by the manufacturer. Regardless of the context of the checklist or format of the form used to documents it, the reference to Start-up Procedures includes all of the stated procedures.
- VV. Start-Up Test: This is a test that may be involved with equipment start-up. It differs from a checklist item in that it requires more than a binary (yes/no, OK, Not OK) response an observation, measurement, or sequence of events must be documented. Start-Up Tests are one component of the Start-Up Procedures (Start-Up Checklists being the other).
- WW. Substantial Completion: As defined in the Owner-Contractor agreement. This milestone will coincide with the Functional Acceptance of the systems. This milestone also coincides with the start of the warranty period.
- XX. TAB: Can refer to the test, adjust, and balance process or the Testing, Adjusting, and Balancing Contractor.
- YY. Testing Agency: An independent agency typically retained by the Contractor to perform specialized testing of systems or equipment (most commonly electrical). The Testing Agency shall be qualified and equipped to perform the testing and shall submit appropriate qualifications.
- ZZ. Trending: Monitoring and recording a history of parameters typically using the building automation system.
- AAA. Vendor: Refers to the organization that sold a system or equipment to the subcontractor. This may be a branch office of the manufacturer or a value added reseller.
- BBB. Warranty Period: the period defined by the construction documents where elements of the facility are under contractual warranty
- CCC. Warranty Phase: Includes the early occupancy of the building and can continue through the contractual Warranty Period and at least into the opposite season from when the facility systems were initially tested

### 1.7 REFERENCE STANDARDS

- A. ASHRAE Guideline 0-2013, "The Commissioning Process"
- B. ASHRAE Guideline 4-2008 Edition, "Preparation of Operating and Maintenance Documentation for Building Systems"
- C. NEBB Procedural Standards for Building Systems Commissioning
- D. SMACNA IAQ Guidelines for Occupied Buildings under Construction

### 1.8 DOCUMENTATION

- A. Contractor shall provide to the Commissioning Authority the following per the procedures specified herein and in other Sections of the specification:
  - Shop Drawings and Product Data: CxA shall be provided shop drawings and submittal data for systems and equipment that will be part of the Commissioning process. Some of these submittals will be reviewed by the CxA and others are only needed for record. CxA will mark up the Submittal Register to indicate what is required.
    - a. Submittals to be reviewed: GC shall provide the CxA one electronic copy of Shop Drawings and Product Data concurrent with distribution to the A/E. Commissioning Authority shall review and incorporate comments via the Design Engineer. GC shall then copy CxA with the reviewed submittal with A/E approval stamp.
    - b. Submittals for Record: GC shall provide to the CxA the final electronic record copy of the submittal.
  - 2. Draft Start-Up Procedures: Contractor shall assist in development of Start-up Procedures for all applicable equipment and systems along with the manufacturer's application, installation and start-up procedures. CxA will initially provide to the Contractor generic Start-up Checklists, the content of which must be reviewed by the Contractor and supplemented with manufacturer-specific requirements and the Contractor's own internal quality assurance procedures and checks. CxA will review draft and recommend approval.
  - 3. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase.
  - 4. Schedule Updates: Issue periodic updates to the construction schedule as specified. Provide electronic copy of each update to the CxA. Contractor shall use schedule to notify Commissioning team of scheduled start-up and training activities.
  - Temporary Conditioning Plan: Contractor shall provide initial Temporary Conditioning Plan for approval and then issue periodic updates to reflect actual conditions. At the completion of the Temporary Conditioning, the final plan shall be submitted with completed maintenance records, inspection and check logs, operating logs, etc.
  - 6. Action Item Response: Respond to Action Items to which Commissioning team members assign the Contractor responsibility.
  - 7. Field Testing Agency Reports. Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase.
  - 8. Completed Start-Up Procedures: Completed Start-Up Procedure documentation for all applicable equipment and systems. Provide prior to the start of the Acceptance Phase. CxA will review prior to FPT.
  - 9. Training Plan: Provide prior to the start of the Acceptance Phase.
  - 10. Record Training Documentation: Provide at least 7 days prior to the start of the applicable training session. The compiled and final record training documentation will be provided by the GC within 14 days of the last training session provided under the construction contract (this will typically be the site specific controls training). This will take the form of the Training Plan supplemented with evaluations and actual dates and topics.

11. O&M Manual Content: Provide O&M Manual content per the requirements of this section, and Division 1 requirements. Submit at least one month prior to the beginning of the Acceptance Phase.

### 1.9 COMMISSIONING SEQUENCING AND SCHEDULING

- A. Commissioning Scheduling: Contractor shall incorporate the commissioning process into the project schedule. Start up, TAB, and Functional Performance Testing shall be itemized as applicable for each system/area. Contractor must schedule adequate time for functional testing, after completion of start-up and TAB services for each respective system, CxA will review the duration for the tasks.
- B. Refer to the sequencing illustration at the end of this Section for a conceptual graphical representation of the precedents related to the Commissioning tasks. These precedents are generally to be applied per system and/or per area. Where applicable, in order to expedite the close out of the facility, various systems can be in various stages of the commissioning process. CxA and Contractor shall cooperate to schedule the Commissioning tasks to minimize the duration of the Commissioning activities.

## 1.10 COORDINATION MANAGEMENT PROTOCOLS

- A. Coordination responsibilities and management protocols relative to Commissioning are initially defined below but will be refined and documented in the Construction Phase Commissioning Kick Off meeting. Contractor shall have input in the protocols and all parties will commit to process and scheduling obligations. The CxA will record and distribute.
  - 1. Submittals and Shop Drawings: GC shall distribute these to the CxA. CxA shall edit the Systems Matrix to communicate which submittals must be forwarded.
  - 2. CxA Review Comments on Shop Drawings: Posted on the electronic forum and a copy sent directly to the A/E and Owner PO by the CxA. A/E to consider and incorporate at their discretion.
  - 3. Deficiencies Identified by the CxA: When the CxA identifies a deficiency, CxA shall make a good faith assessment of responsible parties. Those parties, and the Cx Team shall be notified of the perceived deficiency. This communication is FOR INFORMATION ONLY and is not a direction of resolve the deficiency. Contractor may accept responsibility and resolve the deficiency voluntarily. If contractor contests either the deficiency or responsibility for that deficiency, Contractor shall respond to that deficiency indicating disagreement. If responsibility is not agreed to via the Commissioning dialogue, GC shall issue a work directive or RFI via the normal contractual channels to resolve the issue.
  - 4. Requests for Meetings: In general request by the contractor for a meeting with the CxA shall be routed through Owner PO who will then determine the validity. Note that every attempt should be made to deal with Commissioning issues at Commissioning Meetings.
  - 5. Control Sequence Modifications: CxA shall make every attempt to thoroughly review the sequences during the submittal phase and address any issues prior to the submittal approval. However, CxA and the ATC may incorporate minor changes to the sequence during testing when it is apparent that it improves the

- control of the equipment but does not fundamentally change the sequence. The time required by the ATC for this type of modification is addressed in Section 230800. Any and all changes must be thoroughly documented in the record documents.
- 6. Scheduling Coordination CxA shall consult directly with the GC to incorporate the Commissioning tasks in the project schedule. The process logic and integration shall ultimately be a collaboration between GC, CxA, and subcontractors. The effort will start with CxA and GC proposing initial logic. Then sub-contractors will join the discussion and work out the final details, (precedent logic and durations).
- 7. Notification of Completion Milestones Contractor shall notify Owner at least two weeks prior to an anticipated commissioning activity or commissioning milestone (such as ready for FPT). GC CxC shall then coordinate the scheduling of the activity (as applicable) between all required parties as applicable. Notification shall be posted using the Commissioning Portal Events Module with an associated Action Item distributed to interested parties.
- 8. Action List: CxA maintains a categorized Action List which tracks the Commissioning related action items. All content of the Action List will be available to all parties who have credentials on the portal. Any party with credentials may post an Action Item. Any party that is copied on an email resulting from an Action Item posting may respond to it and contribute to the dialogue.
- 9. Start-up Checklist and Test Documents: CxA will provide initial "generic" start-up checklists to the contractor. The contractor shall review these with respect to the manufacturer specific start-up procedures and provide comments for the CxA to update and post final, vendor specific checklists. The Contractor then performs the approved Start-Up procedures and enters the results on the Project Portal if being utilized during this phase of the Project. CxT subsequently spot checks the procedures and documentation. They are then included in the Commissioning Record
- 10. Functional Performance Test Documents: Functional performance tests are prepared and completed by the CxA. They are developed during the construction phase generally after completed submittals. CxA forwards the FPT procedures to the GC to be subsequently distributed by them to the subcontractors for review. Contractors approve the procedures. Throughout the Commissioning process, CxA maintains a current record of the testing procedures and keeps the documentation up to date and accessible for all to access the current progress.

### 1.11 CONTRACTOR RESPONSIBILITIES

- A. Construction Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Construction Phase.
  - 1. Include Commissioning requirements in price and plan for work.
  - 2. Designate a Commissioning Coordinator (CxC) from each major subcontractor with activities related to commissioning. These Commissioning Coordinators are to be the primary contacts for Commissioning activities.
  - 3. Attend Construction Phase Commissioning Kick Off Meeting. The Commissioning Coordinator and Project Manager from each major subcontractor shall attend.
  - 4. The Commissioning Coordinator shall attend all Commissioning progress meetings unless otherwise agreed to by the CxA.
  - 5. Remedy any deficiencies identified throughout construction.

- 6. Review draft Start-Up Procedures and comment with respect to Vendor Specific start-up requirements.
- 7. TAB shall submit sample balancing forms for approval prior to starting work.
- 8. Schedule and coordinate Commissioning efforts into the construction schedule. Incorporate the precedent diagram provided by the CxA into the construction schedule. Indicate at a minimum all tasks enumerated on the precedent diagram for all systems.
- 9. Coordinate the work of subcontractors, vendors, manufacturers, and Testing Agencies provided with the bid, and ensure that they are informed of and are adhering to the requirements of the Commissioning process specified throughout the contract documents. Particular reference is made to providing the required O&M Documentation; to submittal of training materials and documentation of that training; to collaboration with the overall start-up and testing process; to developing comprehensive integrated procedures for scheduling and task notification and documenting them in a common format; and to electronic delivery requirements if applicable.
- 10. Develop and submit Temporary Conditioning Plan
- 11. Provide assistance to the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review test procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
- 12. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere this section.
- 13. Start-up, test, adjust, and balance systems and equipment prior to verification and performance testing by the Commissioning Authority. Start-up procedures shall be in accordance with Contract Documents, reference or industry standards, and specifically individual Commissioning specifications. Provide skilled technicians qualified to do the work required. Provide factory trained/authorized technicians where required by the contract documents and stated in the applicable technical section. Generally start-up and testing shall proceed from device checkout, to component checkout, to system checkout, to inter-system checkout.
- 14. Prepare spaces with adequate security for on-site contractors to store equipment. Provide secure space with 120 volt AC power for the CxA, TAB, and ATC to base their operations and store test equipment, drawings, files, and the like.
- 15. Schedule for representative space mock ups as early as possible to facilitate determining standards for close out
- 16. Record start-up and testing procedures on start-up forms or checklists and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the party actually performing the task or procedure.
- 17. Provide skilled technicians qualified to perform the work required.
- 18. Provide factory-trained and authorized technicians where required by the Contract Documents.
- 19. Record Start-up Procedures on start-up procedure forms on the Project Portal if applicable and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above. Each task or item shall be indicated with the Party actually performing the task or procedure.

- 20. Tag equipment that is started with the Individual's name and date.
- 21. Demonstrate the operation of all systems as specified.
- 22. Certify that systems have been installed and are operating per Contract Documents prior to Functional Performance Testing.
- 23. Maintain an updated set of Record Documentation as required by the Contract Documents.
- 24. Copy the CxA on indicated documentation.
- 25. Conduct and document Equipment and Systems Training events as required by this Section and Sections 019114, 019115, 230800, 260800 and applicable sections of the Specifications pertaining to each piece of equipment or system.
- B. Acceptance Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Acceptance Phase.
  - 1. Assist CxA in functional performance testing. Assistance will generally include the following:
    - a. Manipulate systems and equipment to facilitate testing (in most cases this will entail only an initial sample).
    - b. Provide any specialized instrumentation necessary for functional performance testing. Instrumentation outside of that required to complete the work will not be required.
    - c. Manipulate BAS and other control systems to facilitate functional performance testing (in most cases this will entail only an initial sample).
  - 2. Correct any work not in accordance with Contract Documents.
  - 3. Participate in Training Events relative to use of O&M information and the PM program.
  - 4. Maintain record documentation, and update and resubmit it after Functional Completion.
  - 5. Compensate CxA for additional site time incurred due to incompleteness of systems or equipment at time of Functional Performance Testing.
- C. Warranty Phase: The following delineates the commissioning-related responsibilities of the Contractor (and their subcontractors) during the Warranty Phase.
  - 1. Provide warranty service;
  - 2. Conduct BAS Sequence Training
  - 3. Respond to and document Warranty issues
  - 4. Participate as required in the opposite season testing;
  - 5. Correct any deficiencies identified throughout the Warranty Phase;
  - 6. Update record documentation to reflect any changes made throughout the Warranty Phase and resubmit final Record Drawings at the close of the Warranty period.

## 1.12 EQUIPMENT SUPPLIER/VENDOR RESPONSIBILITIES

- A. Construction Phase: The following delineates the commissioning-related responsibilities of the Equipment Supplier (and their subcontractors) during the Construction Phase.
  - 1. Provide shop drawings and product data in hard copy and electronic format.

- 2. Provide manufacturer's application, installation and start-up instructions within 30 days of shop drawing/product data approval.
- 3. Where factory-authorized start-up is specified, coordinate and participate in the specified commissioning process and document start-up on the appropriate forms.
- 4. Review and approve Functional Test Procedures affecting supplied equipment.
- 5. Where training is to be provided by factory-authorized personnel, provide required Training Plan information including course content for approval prior to conducting the training.
- 6. Conduct and document Equipment and Systems Training events as required by this Section and by applicable sections of the Specifications pertaining to each piece of equipment or system.
- 7. Provide spare parts and materials as required by Specifications.
- 8. Provide special tools as required by the Specifications.
- 9. Provide all warranties.
- B. Acceptance Phase: The following delineates the commissioning-related responsibilities of the Equipment Supplier (and their subcontractors) during the Acceptance Phase.
  - 1. Participate in any Functional Testing Procedures as required.
  - 2. Consult on issues identified relative to the supplied equipment.
- C. Warranty Phase: The following delineates the commissioning-related responsibilities of the Equipment Supplier (and their subcontractors) during the Warranty Phase.
  - 1. Provide any warranty service required to the supplied equipment as applicable with the agreement with the Contractor.
  - 2. Provide technical support to the Owner's facilities personnel.

### 1.13 START-UP PROCEDURES AND DOCUMENTATION

- A. Purpose: The Commissioning process requires that the normal quality control processes involved with preparing systems and equipment for operation are performed to a high standard of care and are thoroughly documented. The required commissioning-related Start-Up Procedures involve nothing additional than that which would be done for any good installation. These procedures shall be performed to all installed systems and equipment and no sampling strategy is used for the start-up process. The Commissioning process requires all Parties to collaborate to establish the optimal standard of care for starting systems and equipment. After the procedures are established, the Contractor performs them and documents them with the Start-up Procedures that are developed by the joint effort of the Contractor and the CxA.
- B. Manual Creation of Start-up Procedures: Start-up Procedures (consisting of checklists and tests as above) for each type of equipment and system shall be created by the CxA and reviewed by the Contractors prior to start-up. These may be supplemented with Vendor specific start-up forms when approved by the CxA.
- C. 'Generic' Start-Up Procedures: Refer to Sections 230800 for generic Start-up Procedures for a variety of mechanical and electrical systems. The content of these Start-Up Procedures shall provide the minimally acceptable content. Prefunctional documentation will be created by the CxA. Generic refers to the fact that the protocols

may be created before the shop drawings are finalized. These procedures and protocols will be those common across different manufacturers.

- D. Content of Start-Up Procedures: Start-Up Procedures shall generally include the following for each item of equipment or system (as applicable):
  - 1. Project-specific designation, location and service.
  - 2. Indication of the Party performing and documenting the Start-Up Procedure.
  - 3. Clear explanation of the inspection, test, measurement, and outcome with a Pass/Fail indication and a record of measure parameters.
  - 4. Include a checklist item indicating that all O&M instructions, Warranties, and Record Documents have been completed and submitted.
  - 5. Include a Start-up Checklist item indicating that proper maintenance clearances have been maintained.
  - 6. Include a Start-up Checklist item indicating that special tools and/or spare tools required for normal operation and maintenance were turned over to the Owner.
  - 7. Include Start-up Checklist item indicating that all required dependent or prerequisite equipment and systems were previously started successfully.
- E. Manufacturer's Requirements: Start-up Procedures shall incorporate all manufacturer-specified procedures. As applicable, include acceptance criteria specified therein. The manufacturer's start-up and checkout procedures shall be submitted to the CxA along if they are to supplement the CxA generated forms.
- F. Recording and Documentation of the Start-up: Manufacturer's start-up protocols shall be executed and forms shall be completed by a qualified/authorized technician. These shall either be produced electronically or shall be scanned and submitted electronically.
- G. Recording and Documentation of Prefunctional Checklists and Tests: Generally, in concert with the start-up process, the prefunctional tests and checklists shall be completed by a qualified technician. The information contained in the checklists is the minimum amount of information that will be completed in the database.
- H. Related Sections and Contract Documents: Refer to the technical specifications and commissioning-related Sections for additional information.
- I. CxA Review: CxA shall review the draft Start-Up Procedures and request any additional information required to meet the Commissioning criteria. CxA will also review and spotcheck procedures during Functional Performance Testing.
- J. Documentation Completion: The individual executing the startup must complete the start-up and prefunctional documentation for any given equipment and acknowledge acceptability with the indication of who did the associated task. As approved by the CxA, in some cases the subcontractor as opposed to the manufacturer's start-up technician may complete the prefunctional information. Whether done on paper in the field or done directly into the computer, all data shall be entered into the project database.
- K. Sampling and Final Submission: All (100% of) systems are started and documented per the approved procedures and NO sampling strategy is used. Completed Start-up and prefunctional checklists for all pieces of equipment shall be submitted to Commissioning Authority prior to any associated Functional Performance Testing (FPT). Any outstanding

item shall be clearly identified and an associated Action Item must be entered to track resolution.

L. Owner Access: Contractor shall allow access by Owner representatives to inspect the equipment and ensure its proper operation. Owner will be allowed to affix service tags to equipment to track the proper maintenance.

#### 1.14 FUNCTIONAL PERFORMANCE TESTING

A. The objective of Functional Performance Testing is to demonstrate that each system is operating according to the documented Design Intent Document and Contract Documents. Functional Performance Testing facilitates bringing the systems from a state of Substantial Completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

### 1.15 DEFICIENCIES IDENTIFIED DURING FUNCTIONAL TESTING

- A. Non-Conformance. Non-conformance deficiencies identified during Functional Performance Testing shall be resolved as follows:
  - 1. The CxA will record the results of the functional test in the project database witnessed by CxA. All deficiencies or non-conformance issues shall be noted as Action Items and reported to the Owner and Contractors.
  - 2. Corrections of identified minor deficiencies may be made during the tests at the discretion of the CxA. In such cases the deficiency and associated resolution will be documented in the database.
  - 3. Every effort will be made by the CxA to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
  - 4. As tests progress and a deficiency is identified, the CxA will discuss the issue with the executing Contractor.
    - a. When there is no dispute on the deficiency and the Contractor accepts responsibility to correct it:
      - The CxA shall document the deficiency along with the Contractor's response and intentions, and they go on to another test or sequence. A copy/email of the deficiency shall be generated and provided to the Contractor and CxA. The Contractor corrects the deficiency, completes the Action Item response certifying that the issue is resolved, and /or the equipment is ready to be retested, and sends it back to the CxA.
      - 2) The CxA reschedules the test and the test is repeated.
    - b. When there is a dispute about a deficiency, regarding whether it is a deficiency and/or who is responsible:
      - The deficiency shall be documented as an Action Item with the Contractor's response and the GC will be notified. The GC will track this issue under the construction contract dispute resolution provisions.
      - 2) Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.

- 3) The CxA documents the resolution to the Action Item.
- 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, and responds to the Action Item indicating completion. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved. CxA then closes the Action Item.
- B. Cost of Retesting: The cost for the CxA to retest a Start-up or Functional Performance Test shall be paid by the Contractor responsible for the deficiency. Owner shall pay the CxA directly and back charge the responsible Contractor or direct the responsible Contractor to pay CxA and withhold payment to responsible Contractor until CxA has confirmed they have been paid by the responsible Contractor.
- C. Failure Due to Manufacturer's Defects. If 10% or three, whichever is greater, of identical pieces of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, all identical units may be considered unacceptable. (For the purposes of defining 'identical equipment' for this Section, size or capacity alone does not constitute a difference.) In case of failure due to manufacturer's defects, the Contractor shall provide the Owner with the following:
  - 1. Manufacturer's response in writing as to the cause of the failure and proposed resolution.
  - 2. Manufacturer shall implement their proposed resolution on a representative sample of the product.
  - 3. The Owner will determine whether a replacement of all identical units or a repair is acceptable.
  - 4. Upon acceptance, the manufacturer shall replace or repair all identical items at their expense and shall extend the warranty accordingly (if the original equipment warranty had begun).
  - 5. Manufacturer shall pay the costs of all retesting necessitated by the failure.

# 1.16 TRAINING EVENTS

A. General: Adequate and thorough training of the Owner's and the facilities maintenance staff is vital to effective transition and early occupancy of the building. A key goal of the Commissioning Team is to ensure that this is accomplished. Contractors, Subcontractors, and Manufacturers/Vendors as specified shall prepare and conduct training sessions on the installed systems and equipment for which they are responsible. The Contractor shall be responsible for insuring all training is performed in accordance with the Contract Documents.

# B. Training Plan Document

- 1. The Training Plan shall outline the Training Events as proposed by the Contractor, and shall be approved by the CxA. Training Plan shall summarize all equipment and systems-related training events with topics to be covered and approximate training duration.
- 2. The Training Plan shall include at a minimum:
  - a. Topic and applicable specification section;
  - b. Scheduled date(s) for the Events(s);

- Location and setting (classroom or field);
- d. Lead instructor and instructors qualifications;
- e. Co-instructors and their qualifications;
- f. Training objective;
- g. Event outline/agenda;
- h. Detailed breakout of content to be presented;
- i. Anticipated duration;
- i. Required attendees for each session.
- 3. Review: GC shall compile the individual training agendas of the subcontractors and vendors and submit a comprehensive Training Plan to the CxA, Architect and the Owner for review. Contractor shall incorporate comments and requirements resulting from the review and resubmit the Training Plan prior to conducting any training sessions.
- C. Training Prerequisites: Training shall not be conducted until the subject system or equipment is operating properly and after it has been successfully started per the commissioning requirements. If Contractor wishes to schedule both Start-Up and Training on the same day/visit, Contractor shall allow enough time to fully start-up and document start-up of the systems. If the systems are not fully functioning, training will be canceled and rescheduled.
- D. Record Training Documentation: The Contractor must document all training sessions. Beyond that included in the Training Plan, documentation shall include the names of the attendees. Training shall follow handouts that list at a minimum the key points in bulletform presentation style, and presentation handouts shall be provided even when training follows detailed written documentation. Training will not be approved unless it contains accompanying written documentation.
- E. Video Documentation: The Contractor must record all training sessions as noted in specifications.

# 1.17 PHASING PLAN

- A. If contractor intends to start, run, or occupy portions of systems in phases, contractor shall submit a plan for phasing in areas/portions of systems that will be connected subsequent to the initial portions. Specifically address:
  - 1. Pipe and Duct Cleaning: indicate the configurations and protocols for isolating subsequent regions and then protecting the preceding regions when the subsequent region is cleaned/flushed and connected.
  - 2. Pipe disinfection: Indicate the plan for disinfecting each region of potable water that requires disinfection. Indicate how the preceding regions of the system will be protected when connecting subsequent regions.
  - Piping Certification/Testing: Indicate the plan for certifying each region of pipe that
    requires certification and or testing. Indicate how the preceding regions of the
    system will be protected when connecting subsequent regions. Indicate how you
    will verify that the certification/test results on the previous systems have not been
    invalidated.

4. System Modifications: Indicate the protocols for making subsequent changes to the systems of pipe and duct when the systems have already been cleaned, flushed, pressure tested, disinfected, certified, etc.

# 1.18 PRESUBMITTAL COORDINATION MEETING(S)

- A. Pre-submittal Meetings: After approval of the material and equipment list and prior to submitting equipment (Air Handling Units, building automatic temperature control system, DOAS, VAV boxes, cabinet heaters, etc.) shop drawings, the pre-submittal coordination meeting(s) shall be held either at the Engineer's Office or the field office. The attendees shall include at the minimum:
  - 1. General Contractor
  - 2. Equipment Sales Representative responsible for preparing the Shop Drawings
  - 3. Mechanical Contractor
  - 4. Electrical Contractor
  - 5. ATC Contractor (Sales Representative, Control Engineer, and Lead Project Installation Technician)
  - 6. Testing, Adjusting and Balancing Contractor
  - 7. Owner
  - 8. Mechanical Engineer
  - 9. Commissioning Agent
- B. The Equipment Representative and/or the Mechanical Contractor shall be responsible for e-mailing, a minimum of fourteen (14) days in advance, a copy of the Preliminary Submittal to all named parties. The purpose of the meeting is to coordinate requirements and gain a full understanding from all parties as to what is required for a fully turnkey installation as well as to minimize potential rejection of shop drawings. The Commissioning Agent shall coordinate these meetings and shall document and publish minutes of all meetings.

#### PART 2 - PRODUCTS

# 2.1 INSTRUMENTATION

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Installer for the equipment being tested. For example, the Mechanical Contractor shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system, except for equipment specific to and used by Testing and Balancing Contractor in their commissioning responsibilities. The Installer shall provide two-way radios.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents, shall be included in the base bid price to the Contractor and left on site, except for standalone data logging equipment that may be used by the CxA.

- C. Temporary Data logging equipment and software required to test equipment will be provided by the CxA but shall not become the property of the Owner.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5F and a resolution of + or 0.1F. Pressure sensors shall have an accuracy of + or 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

# 2.2 WEB-BASED COMMISSIONING PORTAL

- A. All general and major subcontractors participating in the Cx process shall use the webbased Cx Portal (when used on the Project) to document the Cx procedures. The Portal is a Web-based Internet hub used to electronically collaborate and coordinate activities and deliverables throughout the Cx process. The Portal is hosted by the CxA and shall be accessible to all Parties participating in the Cx program. The Portal provides a common location to store Start-Up Documentation, Functional Performance Tests and results, project documents and deliverables. It also serves as a collaborative email hub to facilitate, automate, and track communications between Parties relating to the Cx process.
- B. Participation: All general and major subcontractors shall participate in the use of the portal to document the Commissioning procedures (where used on the Project). The use of the interface includes the electronic completion of all start-up procedures and the response/interaction with the Action List dialogue.
- C. Requirements for Use: All contractors participating in the portal must have the following based on their use:
  - 1. The portal uses the internet via a standard browser. Allows anyone with credentials to view the Commissioning information. Only individuals associated with the responsible Party can edit that information.
- D. Portal Training: Included in the contract is a half-day training session given by the CxA (ZDS Design/Consulting Services and/or Facility Dynamics Engineering) scheduled near the Commissioning Kickoff Meeting or scheduled prior to the first equipment start-up. These meetings may be e-meetings or physical meetings as determined with the successful Contractors and CxA. Contractors shall send a representative to at least one training session to be able to use the Portal. Each Prime Contractor is entitled to up to two hours telephone technical support beyond training sessions. Any additional telephone support for non-bug related issues beyond this will be at cost to the requesting Contractor on the CxA's time and expense basis.

#### 2.3 TEST KITS FOR METERS AND GAGES

A. Test kits for meters and gauges shall be provided to the Owner new and in good condition. Previously used test kits will be unacceptable. Kits shall be submitted prior to the Acceptance Phase. Kits required are specified in the individual technical specifications and in 230800 and 260800.

#### PART 3 - EXECUTION

#### 3.1 COMMISSIONING MEETINGS

- A. The CxA will schedule, plan and conduct a Commissioning Kickoff Meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CxA. The following should be discussed at this meeting:
  - 1. The Commissioning Documents
  - 2. Requirements and Sequence of Commissioning
  - 3. Responsibilities of the construction parties
  - 4. Management protocols
  - 5. Required submittals
  - 6 Schedule
- B. Miscellaneous Meetings: Other meetings will be planned and conducted by the CxA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular contractors.
- C. The CxA will plan these meetings and will minimize unnecessary time being spent by contractors. For large projects, these meetings may be held monthly (but not likely to begin until construction nears a point that they would be productive), until the final 2 months of construction when they may be held as frequently as up to one per week when deemed necessary by CxA. The entire commissioning team is not required to attend each of these meetings, but will be notified by the CxA prior to the meeting, and will receive meeting minutes from the CxA.

## 3.2 START-UP STANDARD OF CARE

A. Procedures that establish a minimum Standard-of-Care for the start-up, check out and testing of applicable equipment are specified in the individual technical specifications as well as Section 230800. Contractor shall apply this Standard-of-Care and document per the Commissioning requirements.

## 3.3 FUNCTIONAL PERFORMANCE TEST EXECUTION

# A. PARTICIPATION

1. Typically, multiple parties are required for any given test, yet participation for any given party is only required for the respective portion of the test for which the party

- is responsible. For instance, ATC does not have to be present for strainer testing on hydronic loops, only the control related performance testing.
- 2. Frequently, on multiple samples or similar equipment where a given party does not directly conduct the test, the participation of that party will only be required for an initial quantity of systems/equipment. With the contractor's approval, CxA will continue with the remaining portion of the sample without assistance from the contractor. In this case, the time requirement will be indicated as total.
- 3. It is required that the parties be available on site throughout the testing of any given system for which they are required participants. Therefore time for which they are not directly involved can be spent performing other work (typically addressing identified punch list items or failed tests)
- 4. No party involved with the project is prohibited from participation in or witnessing of any tests. Any contractor may elect to witness all tests on their systems even if their involvement is not directly required (for instance, ATC involvement is sometimes required on the first few of a sample and not on the entire sample)
- 5. CxA will endeavor to coordinate effectively with the individual contractors throughout functional performance test and minimize their required involvement.

#### 3.4 ACTION LIST

- A. CxA shall maintain an Action List tracking Action Items (required information, identified deficiencies, work required, etc.) that relate to Commissioning. Each item shall be tracked with the initiator, the parties responsible, due date, the date of closure, and a description of the resolution. Each item shall be categorized for sorting and tracking and for documentation on applicable forms.
- B. CxA will disseminate this list as appropriate to keep all parties informed.
- C. All parties indicated as responsible for an action item shall respond. Parties shall respond via the Web Portal interface (where applicable) to ensure all of the dialogue is documented in the testing database.
- D. The originator of an Action Item shall close it and record the resolution. Closing an Action Item amounts to entering the date on which it was addressed.

# 3.5 SEQUENCING ILLUSTRATION

A. A simplified schematic diagram of the precedents involved in the Commissioning process is provided below. The diagram is generally applicable on a system-by-system basis. Different systems or areas of the building may be phased or sequenced such that different systems are at different points in the Commissioning process. The diagram indicates tasks for the Contractor, the A/E and the CxA. Tasks for each are indicated vertically below their name. The individual tasks are as defined herein. Management protocols are also covered herein.

**END OF SECTION 019113** 

#### SECTION 019114 - FUNCTIONAL PERFORMANCE TESTING

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 WORK INCLUDED

- A. Functional Performance Testing of systems.
- B. Documentation of FPTs.
- C. Acceptance criteria.
- D. Interactive System Functional Performance Testing (FPT) of systems.

#### 1.3 SCOPE

- A. This section describes the Functional Performance Testing (FPT) process, procedures, and requirements. It is intended to illustrate (i) the Contractor's requirements for assisting the Commissioning Authority (CxA) with the functional performance testing of systems, and (ii) to demonstrate the level at which systems and equipment will be tested prior to being deemed 'Acceptable' to the Owner.
- B. The CxA will prepare itemized and detailed testing plans and procedures that:
  - 1. Specify individual tests and procedures that meet the general requirements of the Cx Plan and commissioning process;
  - 2. Serve to document and record the testing procedures and the results of the tests.
- C. The Contractor shall provide technical input to the CxA as needed during the development of the final project FPTs.
- D. Example (referred herein to as 'generic') FPTs are provided as illustration to the Contractor of the level of detail to which FPTs will be conducted.

#### 1.4 RELATED WORK AND DOCUMENTS

- A. The Commissioning Plan outlines the commissioning process.
- B. Section 019113 General Commissioning Requirements: details the Cx requirements common across all divisions
- C. Section 019114 Functional Performance Testing Procedures: Outlines the generic functional testing procedures required.
- D. Section 019115 Commissioning Plan with preliminary Pre-Function and Functional Performance Testing (FPT) documentation.
- E. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- F. Section 230800 Mechanical Systems Commissioning: Details the commissioning procedures specific to HVAC work.

# 1.5 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019113.

# 1.6 FUNCTIONAL PERFORMANCE TESTING

- A. Objectives and Scope: Systems shall be tested to ensure proper operation through all modes of operation including normal expected operation, maintenance operation as well as proper response to system and component failures that are considered abnormal operation as indicated below.
  - 1. Normal Operation: In general, each system shall be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. These series of tests will demonstrate that the systems and equipment operate throughout typical operation including normal adjusting, cleaning, media replacement, and maintenance.
  - 2. Abnormal Operation: Test each system to simulate possible abnormal conditions and verify proper responses to such modes and conditions as power failure, equipment and component failure, freeze condition, deviation of operating parameters outside of normal, no flow, supporting utility failure, human error, etc. This series shall demonstrate proper and safe response to the focus systems and the other systems that it affects or integrates with. These tests shall also demonstrate proper enunciation of abnormal conditions to quickly and effectively notify users and operators of such condition. Specific modes required in this project are given in this section and any other sections where test requirements are found.
- B. Development of Test Procedures. CxA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Prior

to execution, the CxA shall provide a copy of the test procedures to the Contractor who shall review the tests for feasibility, safety, equipment and warranty protection, and scope.

- 1. Contractor shall review the FPTs in detail and approve them.
- 2. The CxA shall review Owner-contracted testing, factory testing, or required Owner acceptance tests for which the CxA is not responsible to oversee. Review shall include content, scope, and documentation format, and shall determine what further testing or format changes may be required. Redundancy of testing shall be minimized.
- 3. The purpose of any given specific FPT is to verify and document compliance with the stated criteria of acceptance.
- C. Scheduling: After Contractors notification that systems are ready for testing and submittal and review of all the required submittals has occurred, GC shall schedule the testing. To the extent practical, tests shall be scheduled to allow efficient and contiguous testing of inter-related systems and equipment.
- D. Phasing: Non-interdependent segments of the project testing can be phased. Actual phasing of this project will determine the systems which can be phase-tested. CxA will coordinate the scheduling with the GC and project Team.
- E. Participation: CxA will direct and conduct functional performance tests after Start-Up procedure documentation of systems and equipment has been reviewed and accepted. Conceptual procedures for the functional performance testing are outlined elsewhere in this Section. CxA will witness the FPTs unless otherwise specified. Contractor shall assist with manipulation of the systems or equipment, provision of supporting equipment or materials (lifts, ladders, specialty test equipment, safety equipment), and on-the-spot remediation of minor identified deficiencies whenever possible. Contractor support shall be at the direction of the CxA as follows.
- F. The Contractors have been allotted "FPT Support Hours" in Part III of this Specification Section. This time includes only that for demonstration of the systems, at the direction of the CxA, outside of any other testing. Testing witnessed by the CxA in the presence of other various Contractors or vendors does not constitute time accrued against these hours. Similarly, start-ups, repairs, warranty, training, vendor training, any directly referenced task hours in the specifications, etc. are outside of these hours.
- G. Time required by the Contractors to re-test failed systems, components, or integrated tests which did not meet specification in the initial testing; responding to action items; or repairing/resolving deficiencies do not count against the FPT Support Hours allotment.
- H. The CxA will request the Contractor support in a minimum of 2-hour increments. The Contractors must supply a qualified technician or trade contractor, skilled in the respective area of systems testing, to work with the CxA.
- I. No Party involved with the project is prohibited from participation in or witnessing of any tests. Any Contractor may elect to witness all tests on their systems even if their involvement is not directly requested by the CxA. In this instance, none of the time for that person will be counted as FPT support from the pool of hours.

- J. CxA will endeavor to coordinate effectively with the individual Contractors throughout FPT and minimize their required involvement.
- K. Contractor assumes responsibility for damage to systems conducted in accordance with the approved procedures.
- L. Detailed Test Procedures and Contractor Review: CxA will prepare detailed and itemized testing procedures to define and document the FPT. These will be developed during the Construction Phase and completed during the Acceptance Phase. The CxA shall submit these procedures to the Contractor for review. Contractor shall indicate all required limitations, safety procedures, maximum thresholds, and any other parameters during the FPT development. Contractor shall be responsible for any damage to the equipment caused by functional performance testing done per the procedures and within the limitations of the approved procedures.
- M. Completeness: All systems must be completed and ready for FPT. All start up, factory authorized field testing, independent testing agency tests, and TAB procedures must be complete, and the control systems must be tested and started for the respective system or component.
- N. Test Documentation: CxA will conduct tests, and/or witness tests as applicable. CxA will record all test results on the forms developed for the testing. CxA will 'Pass' or 'Fail' the testing and record the date and time of the test. Deficiencies shall clearly be indicated when the test is failed. When all related testing is completed successfully, CxA shall recommend acceptance of the system or component.
- O. Deficiencies and Re-Testing: When deficiencies are identified during testing, depending on their extent or magnitude, they can be corrected during the test and the testing can continue to successful completion. More significant deficiencies will require failure of the test and re-testing. Deficiencies of this magnitude will result in an Action Item on the Action List. The resolution of the deficiency will then subsequently be tracked by the CxA via the Action List. All tests shall be repeated until successful completion. Refer to more specific provisions below.
- P. Sampling: Identical equipment (such as terminal devices) will be tested using a sampling strategy (20% of the equipment).
- Q. Max Failure Limit and Sample Percentages: A Maximum Failure Limit is indicated along with the Sampling Percentages. The Max Failure Limit indicates the maximum percentage of the tested devices that may have any test that fails before an entirely new sample must be tested. This is based on the concept that if many failures occur, it is a result of inadequate start-up by the Contractor. When the maximum number of failures is reached, testing on that sample will be terminated and re-testing will be scheduled.
  - 1. If no Max Failure Limit is indicated, all tested samples must pass (Max Failure Limit 0%).
  - 2. Where sample tests involve multiple systems (i.e., checking strainers on different hydronic systems) the Maximum Failure Limit will apply per system.
  - 3. The responsible Contractors shall pay the CxA cost of that sample test, and redo the start-up/TAB for the applicable devices/systems.
  - 4. All work necessitated by sample failures shall be at no cost to the Owner.

- R. Opposite Season Testing: Testing procedures shall be repeated and/or conducted as necessary during appropriate seasons. Opposite Season testing will be required where scheduling prohibits thorough testing in all modes of operation. Air handler and central heating system testing for heating-related modes of operation and control loops shall be tested during outside air temperatures below 35°F unless pre-approved by CxA.
- S. Approval. The CxA passes each test and subsequently recommends approval to Owner or GC who reviews and approves the FPT.

#### 1.7 COORDINATION BETWEEN TESTING PARTIES.

- A. Factory Start-Ups: For many systems and equipment, Factory Start-Ups are specified. These Factory Start-Ups will be reviewed and checked during functional performance testing. All costs associated with the Factory Start-Ups are included with the bid unless otherwise noted. In general, Contractor shall make notification of when Factory Start-Ups are occurring and coordinate these with witnessing Parties. The CxA and CxT members may witness Factory Start-Ups at their discretion. Aspects of functional performance testing accomplished during the Factory Start-Ups may be accomplished and approved by the CxA if they meet the intent of the FPT.
- B. Independent Testing Agencies: For systems where Independent Testing Agencies are specified, the cost of this testing is included with the bid unless otherwise noted. Much of the testing performed by these independent agencies will cover aspects required in the Start-Up Procedures and functional performance tests.
  - 1. Contractor and testing agencies shall coordinate with the CxA so that the CxA can witness the testing and approve the applicable aspects of the FPTs.
  - 2. The CxA may in some cases independently spot-check work of the testing agencies if the tests were not witnessed. However, it is not the intent for the CxA to re-accomplish testing by others that is specified in the construction specifications. For instance, much of the testing requirements for the electrical systems will be performed by the independent electrical testing agency provided under the bid. The CxA shall witness the indicated sample of the testing and record the results in the record of functional performance tests.
  - 3. Contractor is responsible for coordinating the efforts of testing agency with that of the Cx process. Documentation shall be contiguous and seamless and duplication should be avoided. Testing agencies shall complete the documentation of the Cx process as required.
- C. Specialized Testing by Contractor: Where specialized testing is specified in the technical specifications, Contractor, subcontractor, vendor, or factory representative as applicable shall conduct the specified testing and provide all specialized instrumentation and equipment. CxA and other CxT members may witness tests at their discretion. The CxA may in some cases independently spot-check the results of the tests if the tests were not witnessed. However, it is not the intent for the CxA to re-accomplish testing that is specified in the construction specifications. All specialized testing procedures shall be integrated with the Cx process and all documentation shall be coordinated and integrated with the documentation of the Cx process. Examples of specialized testing include:
  - 1. Acceptance testing of the Fire Alarm System

# 2. FPT Acceptance Criteria

- D. The Acceptance Criteria shall be as follows unless more specifically indicated within individual tests. CxA may exercise professional judgment to relax requirements and pass tests and recommend approval when appropriate.
  - 1. Capacity and/or equipment performance will generally be as specified ±5%.
  - 2. Efficiency where specifically indicated in the documents will be ±5%. When inferred from manufacturer's catalogue data, criteria will be ±10%.
  - 3. Balancing-related criteria will be ±5% for water and ±10% for air.
  - 4. Accuracy/repeatability on sensing devices will be as specified for the device. CxA and TAB will use calibrated gauges for independent validation and use judgment in passing or failing the devices. TAB shall provide all instruments required unless CxA pre-approves otherwise. In many cases, the coordination of multiple related sensors is more important than absolute accuracy.
  - 5. Loop response and setpoint deviation criteria will be as specified
  - 6. HVAC sequence-related criteria will be as explicitly specified in the documents and as interpreted by the CxA. Code required sequencing shall be per the applicable code.
  - 7. System sequences shall be as required by the approved shop drawings.
  - 8. Motor Phase Imbalance: Shall be no more than 2% (Amps and Volts).
  - 9. Noise Levels: Occupied spaces: noise level shall be as recommended in the most current version of the ASHRAE Handbooks for the applicable occupancy.
  - 10. Indoor Environmental Parameters (T, RH): Shall be as indicated in the Basis of Design document. Otherwise, as recommended in the most current version of the ASHRAE Handbooks for the applicable occupancy. I.e., General Occupied Rooms: Setpoints from 70-75F +- 3F and 45% RH +- 15% RH
  - 11. Air Pressurization: As indicated in the most current version of the ASHRAE Handbooks for the applicable occupancy.
  - 12. Indoor Lighting Levels: As recommended in the most current version of the IES Handbooks for the applicable occupancy.
  - 13. Electrical Systems: Shall be in accordance with manufacturer's recommendations of individual components and devices, NFPA 70B and International Electrical Testing Association (NETA) testing specifications NETA ATS-Latest Version.

#### PART 2 - PRODUCTS

# 2.1 INSTRUMENTATION

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Installer for the equipment being tested. For example, the Mechanical Contractor shall ultimately be responsible for all standard testing equipment for the HVAC system and controls system, except for equipment specific to and used by Testing and Balancing Contractor in their commissioning responsibilities. The Installer shall provide two-way radios.
- B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents,

- shall be included in the base bid price to the Contractor and left on site, except for standalone data logging equipment that may be used by the CxA.
- C. Temporary Data logging equipment and software required to test equipment will be provided by the CxA but shall not become the property of the Owner.
- D. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or 0.1°F. Pressure sensors shall have an accuracy of + or 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

# PART 3 - FUNCTIONAL PERFORMANCE TESTS (Systems and Equipment Related)

# 3.1 PREREQUISITES

- A. All equipment, components, and devices applicable to the FPT must be started and the Start-Up must be documented and passed. This includes completion of Start-Up procedures, pressure testing of equipment, duct, piping; flushing/cleaning of applicable systems; completed labeling and identification; completed insulation of applicable systems; and all other requirements for placing system into dynamic operation. The completed, successful, start-up of the systems must be evidenced by the associated checks, tests, and vendor forms filled out and uploaded to the Cx Portal.
- B. Unless specifically agreed to by the Owner and CxA, all support systems shall be complete prior to FPT. For instance, a Boiler Management System will require that:
  - 1. The electrical system serving it is completed and tested;
  - 2. The hydronic systems serving it have been pressure tested, flushed, and functional performance tested;
  - 3. Balancing has been accomplished on the air and water sides:
  - 4. The control systems have been started and calibrated.
- C. The CxA shall determine the optimal sequence of testing.

#### 3.2 FUNCTIONAL TEST PROCESS

- A. Functional Testing on any given system shall generally begin with testing device level elements; progress to component level; to system level, to inter-system level to building level.
- B. Functional Testing of systems shall generally proceed from the utilities to the central systems, to the distribution systems, to the zone terminal units and services. CxA shall plan this process and communicate it through a precedent diagram (i.e. Gantt and Pert

or Excel format). General Contractor or Multi-Prime Contractors as accepted shall reflect that process in the Construction Schedule. Subcontractors shall perform work in accordance with the schedule.

# 3.3 COMMON ELEMENTS FOR ALL SYSTEMS

- A. Required submittal documentation shall be present and located convenient to testing area. Validate that all required documentation has been submitted and is per the contract requirements.
- B. Contractor shall provide the completed Start-Up Procedures at the time of testing. CxA shall review the Start-Up Procedure documentation and spot-check at the beginning of FPT.
- C. Contractor shall demonstrate that access is sufficient to perform required maintenance.
- D. BAS trends shall have been established as required in the documents. These shall generally be reviewed prior to or during FPT.
- E. All dynamic systems powered by electricity shall be tested to simulate a power outage to ensure proper sequencing. Those on emergency power or uninterruptible power shall be tested on all sources.
- F. Capacities and adjusted/balanced conditions as applicable shall be subject to check.
- G. Sequencing Verification: All modes of operation and actions shall be verified for equipment/system samples.
- H. System and equipment configurations shall be compared against the contract documents.
- I. Verify functions (such as heating and cooling) are coordinated and do not overlap or 'fight'.
- J. All adjusted, balanced, controlled systems shall be assessed to determine the optimal setting for the system as applicable. The optimal settings should be determined to establish reliable, efficient, safe and stable operation.
- K. BAS or Local Panel Dynamic Graphics: The graphic displays for all components, systems, and areas required to be represented by a graphic shall be checked for adequacy and accuracy. Furthermore, when setpoints or other parameters are required to be adjustable, CxA shall verify that they can be adjusted directly from the graphic screen.
- L. Emergency power tests for mechanical systems will be conducted in concert with the testing of the emergency power systems. Mechanical contractor shall be available for the power outage test to test mechanical systems under a power outage. This is in addition to the requirements specified for the mechanical system.

- M. Where system and zones are designed for various modes of operations and are indicated as such in the Systems Guide, test representative systems in all modes of operation. This includes:
  - 1. Seasonal Modes
  - 2. Sequencing Modes
  - 3. Emergency Modes
  - 4. Potential configurations of containment zones.

## 3.4 CONTRACTOR PARTICIPATION HOURS

- A. The Trade Contractors shall include an allowance for FPT support of the demonstration of the systems, at the request of the CxA. The FPT Support Hours to be included, as part of the base bid by Trade, are as required including a **minimum** or as required, of the following:
  - 1. General Contractor (Prime Contractor) FPT Support 24 hours
  - 2. Mechanical (HVAC) FPT Support 24 hours.
  - 3. Building Automation System FPT Support 60 hours, if basis of design.
  - 4. Electrical FPT Support 8 hours
  - 5. TAB FPT Support 24 hours

**END OF SECTION 019114** 

# SECTION 019115 COMMISSIONING PLAN

**FOR** 

# WV GENERAL SERVICES DIVISION WV CAPITOL COMPLEX BUILDING #3 HYDRONIC BOILER SYSTEM UPGRADES

Charleston, West Virginia

# **Construction Phase**

Version 1.0 January 09, 2023



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# I. Introduction

# A. Commissioning (Cx) Plan

- 1. This Commissioning (Cx) Plan shall outline the commissioning process for the WV Capitol complex Building #3 Hydronic Boiler System Upgrades. Herein described are the responsibilities of the various Parties involved in the design, construction, and commissioning process and the procedures by which all Parties will endeavor to ensure the facility is designed, installed, started, tested, and documented to meet the Owner's needs and to ensure that the Operator's personnel are fully trained.
- 2. This plan focuses on the overview of the entire process and on the details of the non-construction contract Cx processes. The construction contract requirements are detailed in the project specifications.

# **B.** Project Description

1. This project will generally include the upgrades of WV Capitol Complex Building #3 Hydronic Boilers as shown on drawings and specifications latest version. The commissioning shall be limited to the Boiler systems and related equipment as mentioned on the scope.

# C. Cx Plan Progression

1. The Commissioning Authority has issued this Cx Plan in the construction phase as indicated on the title page. This Cx Plan may evolve throughout the process and be expanded or modified as needed should the construction plan evolves. Subsequent issues of this Cx Plan will be released and posted to the Cx portal at the appropriate stages of the process as needed.

# D. Roles of the Cx Plan versus Cx Specifications

- 1. Although the Cx Plan is designed to cover the rules and roles for the commissioning process, it is intended to primarily govern activities focused from project design through final Construction Documents. The specific requirements of the Contractors are to be delineated within the various Cx-related Specifications so as to minimize the need for the Contractor to consult the Cx Plan.
- 2. Commissioning is the systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. The commissioning process involves all the Parties involved in the design and construction process as well as the Owner and the Commissioning Authority (CxA). It ideally begins in the design process, continues throughout the design and construction process, past acceptance of the building and systems, and into the warranty phase of the building. Primary elements of commissioning include:
  - a. Identifying and documenting the Owner's needs and the requirements of the facility:
  - b. Ensuring that the designed systems are commensurate with and meet the Owner's needs:
  - c. Ensuring that the systems installed are operable and maintainable;
  - d. Testing of the systems to ensure that they are interacting and performing optimally;

- e. Ensuring that the design intent, the installations and the O&M requirements are clearly and thoroughly documented;
- f. Training for the operators and the facility staff to ensure they can operate and maintain the facility per the design intent;
- 3. The Commissioning Authority oversees and coordinates the Cx efforts, although all Parties play a vital role in the commissioning process.
- 4. For convenience, the prefunctional checklists and Functional Performance Tests are included in Appendix A. These documents can be found on the Facility Dynamics Engineering portal. Please refer to the portal for the latest version of these documents as well as the current stage of the completion of the documents throughout the commissioning process.

# II. General

# A. Scope of Commissioning Services

1. The Commissioning Scope of Work for this project includes the HVAC & Electrical systems. Refer to the Commissioning Specifications for further details.

# **B.** Cx Process and Sequence

1. The following provides an overview of the Construction Phase Cx Process and defines the project phases in the terms used in this Plan.

**Construction Phase:** Phase of the project during which the facility is constructed and/or systems and equipment are installed and started. Contractor and subcontractors complete installation, start-up procedures, submit O&M information, establish trends, and perform other tasks per contract. Contractor/Vendors conduct equipment-specific training. Construction Phase will generally end upon completed start-up of systems and equipment and completion of trending requirements.

- All major subcontractors (GC, MC, EC, TAB and ATC) and Operators designate a Cx Coordinator (CxC) to represent them in the Cx process.
- CxA conducts construction Cx kick off meeting.
   At a minimum all CxCs attend.
- Contractor incorporates detailed Cx tasks in project schedule. Contractor actively maintains the schedule throughout the construction phase, presenting an updated schedule at each Cx progress meeting.
- Contractor submits shop drawings and CxA reviews the key ones.
- CxA provides submittal comments on the comment tracking system for AE's consideration. AE responds to all comments, and incorporates CxA's comments into the submittal review at AE's discretion.
- CxA conducts periodic inspections and attends periodic progress meetings. All CxCs attend.
- Contractor submits start up forms, manufacturer specific installation and application instructions.
   CxA and Operators review start up protocol and approve.
- Contractor submits Training Plan.
- CxA and Operators review Training Plan and approve.
- Contractors submit Temporary Conditioning Plan as applicable and CxA, Operators, and AE review and approve.
- Contractor adheres to the Temporary Conditioning Plan.
- Independent testing agencies conduct tests as

required by the construction specifications.

- Contactor provides required notification of "witnessed" start-ups. Operators and CxA witness desired start-ups.
- Contractor provides training per contract documents and Cx requirements. GC distributes, collects and organizes evaluations and Training Documentation.
- Contractor conducts specialized equipment testing as specified in the construction specifications.
- Contractor sets up required BAS trends to document system performance.

Acceptance Phase: The facility and its systems and equipment are inspected, tested, verified, and accepted. This Phase is when most of the formal training occurs. A/E and Contractor finalize 'as built' or record documentation. 'Approved Functional Completion' marks the end of this phase

- Contractors establish trending and monitoring as applicable for systems.
- CxA spot check start-ups and balancing.
- CxA directs/conducts FPTs in which most parties are also participants to some degree, primarily for initial samples. CxA and Operators continue with active functional testing performing repetitive samples.
- CxA documents functional testing and recommends acceptance as applicable.
- Contractor and A/E finish Record
   Documentation and provide copies to CxA.
- Contractor remedies issues causing failed FPTs and CxA retests. Contractor compensates project for failed tests that were their responsibility.

Warranty Phase: Includes the early occupancy of the building and can continue through the warranty period and at least into the opposite season from when it was initially tested. Contractor performs warranty service and corrects deficiencies. Contractor finalizes record documentation to reflect actual conditions at the end of the warranty period. Operators work with the CxA and the design team to fine tune the facility to meet actual occupancy.

- Warranty starts on completion of Acceptance Phase.
- CxA provides final Cx report that documents all start up and checkout, functional testing, action items and their resolution, training agendas and evaluations. GC keeps log of Warranty calls and tracks diagnosis and resolution. Warranty on replaced equipment restarts the specified warranty period for that equipment.
- Operators call GC or subs as directed by GC for Warranty calls.
- Changes made to the facility that affect Record Documentation are reflected in updated record documentation.

# III. PARTIES INVOLVED IN THE CX PROCESS

PARTY	ORGANIZATION	NAME	PHONE	EMAIL
Owner	General Services	Patrick O'Neill	O - (304)-352-5514	Patrick.S.ONeill@wv.gov
	Division WV		M - (304) 380-5829	-
Owner	General Services	Scot Casdorph	O - (304) 352 5518	Scot.R.Casdorph@wv.gov
	Division WV		M - (304) 541 4465	
Owner	General Services	Kari Dean	O - (304) 352-5492	kari.j.dean@wv.gov
	Division WV		M - (304) 382-9714	
Engineer	ZDS	Ted Zachwieja,	O – (304) 755-0075	Ted.ZachwiejaIII@zdsdesign.com
		PE	M – (304) 552-2752	
Architect	WYK Associates	James Swiger,	O – (304) 624-6326	james@wykarchitects.com
		AIA		
Structural	CAS Structural	Carol Stevens, PE	O – (304) 756-2564	calalane@aol.com
Engineer	Engineering		M – (304) 543-7289	
CxA	ZDS	Todd Zachwieja,	O - (304) 755-0075	Todd.Zachwieja@zdsdesign.com
		PE	M - (304) 545-4550	
CxA	ZDS	Vineel Busa	O - (304) 755-0075	Vineel.Busa@zdsdesign.com
			M - (304) 930-9192	
CxA	FDE	David Rush	O - (410) 290-0900	davidr@facilitydynamics.com
			M - (443) 472-6978	
General	[TBD-Prime]			
Contractor				
BAS Contractor	[TBD]			
Electrical	[TBD]			
Contractor				
Mechanical	[TBD]			
Contractor				
TAB Contractor	[TBD]			

# IV. RESPONSIBILITIES

#### A. General

- 1. All Parties involved in the design and construction of the facility bear responsibility in the Cx process. The Cx process does not fundamentally change the responsibilities of the team members from conventional projects where a formal Cx process was not used. The Cx process synthesizes, coordinates, and in some cases supplements and/or formalizes the responsibilities of all Parties.
- 2. The role of the CxA is to oversee the Cx process and to endeavor to assist all other parties in achieving the goals of the project.
- 3. The A/E retains all responsibility for design. The CxA reviews conducted during the design process are solely to assist the A/E and are intended to be constructive. Comments are generally to be considered as suggestions. It shall be the A/E's sole responsibility to incorporate or disregard CxA comments. The A/E shall respond to the comments with justification for disregarding any of the CxA comments.
- 4. Contractors retain all responsibility for the installations. CxA inspections and tests will determine the adequacy and completeness of the installations thereby assisting the Contractor in providing a sound installation. CxA testing does not alleviate Contractor's responsibility for ensuring the systems are complete and functional per the Contract.
- 5. Detailed responsibilities are indicated below. These responsibilities relate only to the Cx process and do not encompass non-commissioning aspects of the project.
- 6. Some scopes or tasks indicated in the following list of responsibilities are further detailed in later sections of this Cx Plan.

# **B.** Architect Responsibilities

- 1. Construction Documents Phase
  - a. Collaborate with the CxA on integrating the Cx requirements and protocols into the General Conditions and Division 1 specification.
     Provide an editable version of the specifications to CxA who will suggest edits for their consideration.
  - b. Prepare thorough, accurate, and clear Contract Documents.
  - c. Send CxA one copy of all review submissions.
  - d. Specify materials and finishes that do not outgas excessive air contaminants and/or cause poor IAQ.
  - e. Reflect the direction provided by Owner via the Systems review in the construction documents.
  - f. Incorporate Cx specifications, Cx processes, Cx requirements and/or related edits in the construction specifications. Clearly specify for instance the point at which warranty starts, when Substantial Completion will be awarded in the context of the Cx testing, etc.
  - g. Read and respond to Owner and CxA comments and questions in a timely fashion. Incorporate Owner and CxA comments/suggestions in Contract

Documents when A/E does not feel they will adversely affect the project.

- h. Update OPR and BOD documents to reflect final design.
- i. Incorporate the Owners direction on equipment nomenclature into the design documents.

#### Construction Phase

- a. Issue necessary changes in construction and copy CxA.
- b. Review shop drawings and product data. Contact CxA prior to approval of pertinent systems/equipment and incorporate CxA's comments in A/E's markup or approval.
- c. Inspect construction in accordance with Owner A/E agreement.
- d. Issue clarifications or interpretations of as required.
- e. Maintain a record set of shop drawings, product data, warrantees, test reports, balance reports, start-up certifications, and other official construction documentation.

# 3. Acceptance Phase

- a. Witness key tests and verifications as selected by A/E.
- b. Consult on and resolve any design related issues/problems that arise during this phase.

# 4. Warranty Phase

CONSTRUCTION DOCUMENTS

a. Consult with O/O as necessary to convey and maintain design intent and respond to any identified deficiencies.

# C. Engineer Responsibilities (MEP)

- 1. Construction Documents Phase
  - a. Collaborate with the CxA on integrating the Cx requirements and protocols into the Division 23 specifications. Provide an editable version of the specifications to CxA who will suggest edits for A/E consideration.
  - b. Prepare thorough, accurate, and clear contract documents.
  - c. Send CxA one copy of all submissions for review.
  - d. Specify materials and finishes that do not outgas excessive air contaminants and/or cause poor IAQ.
  - e. Incorporate Cx specifications, Cx processes, Cx requirements and/or related edits in the construction specifications.
  - f. Develop the initial Systems summarizing the recommended content and submit for Owner review.
  - g. Reflect the direction provided by Owner in the construction documents.
  - h. Consider and respond to Owner's and CxA's comments and questions in a timely fashion. Incorporate Owner's and CxA's comments/suggestions in Contract Documents when A/E does not feel they will adversely affect the project.
  - i. Update OPR and BOD documents to reflect final design.
  - j. Provide schematic and riser diagrams on systems to communicate in a clear and simplified fashion the organization of the systems and

- distribution of capacity.
- k. Incorporate the Owner directed equipment nomenclature into the design documents.

#### Construction Phase

- a. Attend Construction Phase Cx kick off, and progress meetings.
- b. Issue necessary changes in construction and copy CxA.
- c. Review shop drawings and product data. Contact CxA prior to approval of pertinent systems/equipment and incorporate CxA's comments in A/E's markup or approval.
- d. Inspect construction in accordance with Owner A/E agreement.
- e. Participate in the resolution of system deficiencies identified during commissioning, in accordance with the contract documents.
- f. Issue clarifications or interpretations of design intent as required.
- g. Mechanical Engineer shall review and approve balancing reports Division 23 field tests. EE shall review and approve Electrical Testing Agency reports and short circuit study.
- h. Maintain a record set of shop drawings, product data, warrantees, test reports, balance reports, start-up certifications, and other official construction documentation.
- i. Approve Functional Test Procedures.
- j. Author appropriate portions of a "Systems Overview" training for incorporation in the Training Plan.

# 3. Acceptance Phase

- a. Witness key tests and verifications as selected by A/E.
- b. Consult on and resolve any design-related issues/problems that arise during Acceptance Phase.

# 4. Warranty Phase

- a. Consult with Owner as necessary to convey and maintain design intent and respond to any identified deficiencies.
- b. Participate in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning.

# D. Contractor's Responsibilities

- 1. All Phases
  - a. As outlined in Construction Specifications.

# E. CxA Responsibilities

- 1. Construction Document Phase
  - a. Review design phase submissions for system included in the Cx scope as described below
  - b. Prepare, edit and/or supplement specifications to identify Cx requirements
  - c. Issue comments resulting from reviews to O/O and A/E in a timely

fashion.

- d. Attend key design/review meetings as selected by CxA and as required to facilitate work.
- e. Expand the Cx Plan

#### Construction Phase

- Coordinate and direct the commissioning activities in a logical, sequential, and efficient manner using consistent protocols, centralized documentation, and clear and regular communications and consultations with all necessary Parties.
- b. Prepare and conduct Construction-Phase Cx Kick-Off meeting.
- c. Revise the Cx Plan as necessary to reflect agreed upon management protocols and responsibilities.
- d. Collaborate with the GC and the contractors to refine and maintain the project schedule.
- e. Review applicable project submittals (shop drawings, product date, draft TAB reports, Training Plan, etc.) for adequacy and to ensure system functionality.
- f. Perform a detailed review of the BAS shop drawings to ensure sufficient clarity and detail is included as direction to installers and programmers. Submittals adequately reflect required information for start-up and acceptance testing, Owner standards are being applied, and that the system will be functional and reliable commensurate with the Owner's needs and budget.
- g. Generate and distribute generic Prefunctional documentation.
- h. Review and approve Start-Up Test and Checklist forms generated by contractor.
- i. Conduct and document Cx progress meetings to ensure the Cx process stays on track and on schedule.
- j. Inspect installation periodically to observe quality of installation and check conformance to the Cx requirements.
- k. Attend selected progress meetings to observe progress and help expedite completion.
- 1. Maintain the Portal database.
- m. Review TAB execution plan.
- n. Witness selected equipment and systems Start-Up Checks and Tests.
- o. Attend selected equipment training.
- p. Review testing agency reports.

# 3. Acceptance Phase

- a. Review start up documentation and assess readiness for functional testing.
- b. Review trending information.
- c. Review field testing agency reports.
- d. Ensure required documentation is submitted.
- e. Verify (spot check) TAB reports.

- f. Verify (spot check) control component calibration.
- g. Verify (spot check) equipment performance certifications.
- h. Functionally test systems and equipment and recommend approval as applicable when functional requirements are met.
- i. Record Cx procedures and maintain list of Action Items and status of acceptance testing.
- j. Optimize system settings as practical during Functional Performance Testing.

# 4. Warranty Period

- a. Periodically monitor the facility as applicable.
- b. Consult with Owner's facilities personnel relative to issues with system performance and occupancy.
- c. Review record Control Shop Drawings.
- d. Perform opposite season FPT and optimization of the facility given the actual occupancy.

# V. Cx Communication Protocols

#### A. Cx Coordination

- 1. CxA shall communicate the requirements of installation-related commissioning with a kick-off meeting in which the construction phase Cx Plan is presented and reviewed.
- 2. CxA shall solicit participation of the appropriate Parties and ensure that the tasks are being executed and responsibilities are being met.
- 3. CxA shall report progress of the Cx to the Owner and GC.
- 4. A/E shall notify CxA of all design review or other key meetings relative to the CxA's scope of work at least two weeks in advance.

# B. Management Protocols Relating to Cx

1. The CxA has been retained by Owner and subsequently reports to the Owner Project Officer and/or the Owner Cx Coordinator. All work directives initiated by the CxA will go directly to Owner and the GC who will then act upon it as appropriate.

# C. Communication Protocols Relating to Cx

- 1. Cx correspondence shall generally be routed directly between corresponding Parties with copies going to all Parties of the Cx Team. The primary exception to this is when it relates to a work directive.
- 2. No communication from the CxA shall be interpreted as a work directive. All channels for directing work are dictated in the contract documents and the agreements between the applicable Parties. An Action List resulting from testing may be requested by the responsible Party to expedite work, but this is not to imply that it is complete or that the identified deficiencies shall be acted upon or how to resolve them. Contractor acting on any Cx deficiency list is doing so voluntarily.
- 3. Specific types of communications are itemized below. Many of the items included are discussed in further detail elsewhere in the Cx Plan. This presents a brief synopsis of the information flow. Note that these procedures are an initial guide.
  - a. <u>Communication Protocols</u>: These protocols are submitted as a general guide but can be changed at the applicable Cx Kick-Off meeting based on mutual agreement with the owner and GC providing the final approval of any change.
  - b. **Cx RFI**: This shall be an Action Item. Correspondence is direct between the two parties with copies of requests and responses copied to all parties concerned. The GC shall log and track all RFIs.
  - c. <u>Design Documents for Review</u>: The Owner and the GC shall distribute these to the CxA unless they direct the A/E to forward them directly.
  - d. <u>**Design Review Comments**</u>: CxA shall post these to the Project Portal and send a copy directly to the A/E, Owner and GC.

- e. <u>Cx Plan</u>: Developed by CxA and distributed to Cx team members in the Design Phase Cx meeting. CxA to update and maintain plan per discussions and agreements throughout the construction and acceptance phase. Plan shall be posted on the electronic hub and available for download at any time throughout the project
- f. Cx Specifications: These are sections authored by the CxA to communicate the requirements of the Cx process throughout construction. They are developed by CxA and distributed to the Owner and A/E for inclusion in the contract specifications. This occurs at the various phases of design review. AE may comment, but does not have license to change these specifications without the approval of the CxA
- g. **Submittals and Shop Drawings**: GC shall distribute these to the CxA.
- h. <u>CxA Review Comments on Shop Drawings</u>: Posted to the Project Portal and a copy sent directly to the A/E and Owner and GC by the CxA. A/E to consider and incorporate at their discretion.
- i. <u>Identified Deficiencies</u>: When the CxA identifies a deficiency, CxA shall make a good faith assessment of responsible parties. Those parties, as well as Owner and the GC shall be notified of the perceived deficiency. This communication is FOR INFORMATION ONLY and is not a direction to resolve the deficiency. Contractor may accept responsibility and resolve the deficiency voluntarily. If contractor contests either the deficiency or responsibility for that deficiency, Contractor shall respond to that deficiency indicating disagreement. If responsibility is not agreed to via the Cx dialogue, GC shall issue a work directive or RFI via the normal contractual channels to resolve the issue.
- j. Requests for Meetings: In general, request by the Contractor for a meeting with the CxA shall be routed through GC who will then determine the validity. Note that every attempt should be made to deal with Cx issues at regularly scheduled Cx Meetings.
- k. <u>Control Sequence Modifications</u>: CxA shall make every attempt to thoroughly review the sequences during the submittal phase and address any issues prior to the submittal approval. However, the CxA and the BAC may incorporate minor changes to the sequence during testing when it is apparent that it improves the control of the equipment, but does not fundamentally change the sequence. Any and all sequence changes must be thoroughly documented in the record documents, and CxA shall notify A/E of the modification and modify the as-built drawings if applicable.
- 1. <u>Scheduling Coordination</u>: CxA shall consult directly with the GC to incorporate the Cx tasks in the project schedule. The process logic and integration shall ultimately be collaboration between GC, CxA, and subcontractors. The effort will start with CxA and GC proposing initial logic. Then sub-contractors will join the discussion and work out the final details, (precedent logic and durations).

- m. <u>Notification</u>: Contractor shall notify GC at least two weeks prior to an anticipated Cx activity or Cx milestone (such as ready for FPT). Owner and GC shall then coordinate the scheduling of the activity (as applicable) between all required parties as applicable. Notification shall be a posted Action Item which is emailed to the receiving parties. Receiving parties shall then respond to confirm.
- n. Action List: CxA maintains a categorized Action List which tracks the Cx- related Action Items. The Action List is a forum for open dialogue intended to expedite resolution of issues. It is not a contractual mechanism for directing work. CxA will maintain these in the portal.
- o. Start-up and Prefunctional Documentation: As further described in the Cx- related specifications, the CxA will provide initial 'generic' Start-Up and Prefunctional Checklists and Tests to the Contractor. The Contractor shall synthesize these with the manufacturer-specific start-up procedures and submit these (along with the manufacturer's start-up procedures) to the CxA for review and approval. The Contractor has the option of modifying the supplied generic procedures in the delivered format, or by supplementing these with their own procedures and ways to document. The Contractor then performs the final reviewed and approved Start-Up procedures, completes the documentation and signs it, and submits it. CxT subsequently spot checks the procedures and documentation. They are then included in the Commissioning Record.
- p. Functional Performance Test (FPT) Documents: Functional Performance Tests are prepared and completed by the CxA. They are developed during the construction phase, typically towards the end of submittal review. The CxA forwards the generated FPT forms to the GC for information purposes and to be subsequently distributed by them to the Contractors and other CxT members. Subcontractors approve the FPTs. When developing the FPTs, the CxA uses *CACEA* (or the content thereof) to provide a basis for the testing standard to be used and edits them to be project specific. Throughout the Cx process, the CxA maintains a current record of the FPTs and keeps the *CACEA* project and synchronizes with the portal for all to access.

# D. Meetings

- 1. **Construction Phase Cx Kick-Off Meeting**: CxA shall organize and conduct a meeting with all Parties to the Cx process (including Contractors and their CxC) where the Cx process and requirements will be reviewed, and specific management protocols will be determined. Information discussed in this meeting will be incorporated into an updated Cx Plan if applicable.
- 2. **Cx Progress Meetings**: Cx Progress Meetings will be called by the CxA as necessary to facilitate and coordinate the Cx process. Generally, these will be monthly during the start-up, testing and acceptance phase. If needed, additional meetings will be conducted to resolve major issues. Please refer to the portal for recent Cx meetings.

# VI. Project Portal

#### A. General

1. The Cx Portal ('Portal') is a Web-based Internet hub used to electronically collaborate and coordinate activities and deliverables throughout the Cx process. The Portal is hosted by the CxA and shall be accessible to all Parties participating in the Cx program. The Portal provides a common location to store Start-Up Documentation, Functional Performance Tests and results, project documents and deliverables. It also serves as a collaborative email hub to facilitate, automate, and track communications between Parties relating to the Cx process. The Portal uses a hierarchical object tree to represent building systems, components, and devices. From this object tree, one can access associated information at and below the applicable level. All applicable elements of information are associated with the object tree. The Portal facilitates either completing information directly via the software or by printing forms to fill out in the field.

#### B. Modules

- 1. Cx Modules include:
  - a. **Project Files**: This module contains applicable project information such as contract documents, Cx specifications etc. Associated with the Commissioning process.
  - b. <u>Systems</u>: This module is the hierarchical representation of the prefunctional checklists and start tests as well as the Functional Performance Tests for all of the Systems, Components and Devices associated with the systems to be commissioned.
  - c. <u>Action Items</u>: This is a list of required actions, requests for information, deficiencies, and other common actions required during the commissioning process. The Action Items module facilitates tracking these items (associated with object tree where applicable) and is intended for use with Cx-related Action Items. Action Items can be categorized for later filtering. Multiple responses or discussion 'threads' can be tracked in association with the Action Item. Contractors shall use the Action Items module to respond to Action Items.
  - d. **Project Directory:** This module lists all of the contact information for all of the Cx Coordinators associated with the project.
  - e. **Events**: This module is generally used by the CxA to schedule Cx events.
  - f. **<u>Dashboard</u>**: This module is a graphical overview of the Cx progress and is updated live as prefunctional checklists and FPTs are completed.

# C. Requirements for Use

1. All contractors participating in the portal will be sent an invite from the CxA and will simply need a reliable internet connection to access the Portal.

# VII. Construction Phase Cx Task Definitions

# A. Construction Phase Cx Kick Off/Coordination Meeting

- 1. CxA shall schedule and conduct a Construction Phase Cx Kick-Off meeting near the beginning of construction. The following should be discussed at this meeting:
  - a. CxA will present the Cx Plan
  - b. Cx will provide Portal Training
  - c. Requirements of Cx
  - d. Responsibilities of the construction Parties
  - e. Management protocols
  - f. Required submittals
  - g. Schedule
  - h. Equipment and Systems Training

# **B.** Scheduling Collaboration

- 1. Effective and detailed scheduling of the project is absolutely essential to a successful project. The Acceptance Phase and functional testing of a typical building can take several months. While in an ideal world, the contractor would "drop off the keys" to the Cx team and give them the entire facility for this period of time, this is never practical. The Acceptance Phase must be tightly integrated into the construction schedule. When scheduled effectively, the net impact of Cx can be a matter of a few weeks. For this to work effectively, the schedule must map out the precedent logic for all parties to move effectively through the close out process. The close out will amount to a parade of parties following each other. This path must be carefully mapped out and detailed in the schedule.
- 2. The baseline schedule logic should be developed early in the construction phase at the latest. When the GC is on board through design, the preliminary logic can be mapped out in the design phase. The Baseline Schedule cannot be developed until all the subcontractors are on board and all agree to the logic and durations of the tasks.
- 3. Further details of the scheduling are covered in Section 019113.

# C. Cx Progress Meetings

- 1. CxA shall schedule and conduct Cx progress meetings at appropriate times throughout the Construction, Acceptance, and Warranty Phases. Agenda items for the meetings shall generally include:
  - a. Review of previous meeting minutes
  - b. Schedule update
  - c. Action Items
  - d. New Issues
  - e. Coordination and look ahead until the next meeting
- 2. CxA shall document minutes of the meeting and distribute per the management protocols agreed to in the Cx Kick-Off meeting

# D. Cx Review of Submittals

- 1. CxA shall review submittals relating to key systems or equipment. Review is for Cx facilitation and does not replace the review of the A/E.
- 2. CxA shall provide comments on submittals to A/E for inclusion in A/E's review.
- 3. CxA may request information to facilitate preparation of FPTs.
- 4. The following shall be submitted to the CxA:
  - a. Shop drawings/product data and Manufacturer's Start-Up Procedures relative to all equipment and systems subject to commissioning
  - b. Contractor's draft of Start-Up Procedures for all equipment
  - c. Draft balancing reports
  - d. BAS shop drawings
  - e. Test and balance reports
  - f. Performance/capacity certifications
  - g. Factory tests results
  - h. Operation and Maintenance Manual information
  - i. Configuration and/or customized settings for this project
  - j. Warranties
- 5. Contractor shall provide one copy of indicated submittals for CxA.
- 6. CxA will review and approve Cx-related submittals as they relate to the Cx process.

# **E.** Construction Inspections

- 1. CxA shall conduct construction inspections as deemed appropriate by CxA per CxA's agreement with Owner, record observations, and copy Owner and A/E.
- 2. A/E shall conduct construction inspections specified in Owner A/E agreement, record observations, and copy Owner and CxA.

# F. Start-Up Procedures and Documentation

1. **Purpose**: Start-Up Procedures (consisting of both checklists and tests) document the normal procedure of ensuring that systems are properly installed and ready for functional testing. Checklists and tests are developed during the Construction Phase by the respective subcontractor in cooperation with the CxA. They are completed by the installing or start-up Contractor. The Cx process requires that the Contractor's normal quality control processes - used to prepare systems and equipment for operation, and typically included in a quality construction process - are performed to a high standard of care and thoroughly documented. These procedures are generally what would be done for any good installation. These are performed to all systems and equipment and no sampling strategy is used. The Cx process requires all Parties to collaborate to establish the optimal standard of care for starting systems and equipment. After the procedures are established, the contractor performs them and documents them with the Start-Up Procedures.

# G. Action List

- 1. CxA shall maintain an Action List tracking Action Items (required information, identified deficiencies, work required, etc.) that relate to Cx. Each Action Item shall be tracked with the Originator, the Parties responsible, due date, the date of closure, and a description of the resolution. Each item shall be categorized for sorting and tracking and for documentation on applicable forms.
- 2. CxA will disseminate this list as appropriate to keep all Parties informed.
- 3. All Parties indicated as responsible for an Action Item shall respond. Parties participating in the Portal shall respond via the Portal. Other Parties may respond by email.
- 4. The Originator of an Action Item shall close it and is responsible for recording the resolution. Closing an Action Item amounts to entering the date on which it was addressed.

# H. Contractor Notification

- 1. Contractor shall completely install, thoroughly inspect, start-up, test, adjust, and balance systems and equipment. All activities shall be documented on specified forms. Contractor shall notify the GC in writing that systems are complete and ready for verification and functional performance testing. The GC shall then coordinate and schedule the testing and checkout times.
- 2. Contractor shall notify CxA at least 14 days in advance of any tests, start-ups, or training. CxA shall witness selected tests and start-ups.

# I. Identification and Resolution of Deficiencies

- 1. Any Party can identify deficiencies, including the CxA. Those forwarded to the CxA will be documented in the Action List. These shall be items of discussion at progress meetings to determine their legitimacy and decide on appropriate action. However, inclusion in the Action List is not a direction to proceed with any resolution or action. Only the Owner, A/E, GC, or other Party as stipulated in the contract governing the project, can direct work. CxA has no authority to direct work or authorize change orders.
- 2. The Party responsible for the deficiency is responsible for its resolution. Direction to proceed with the resolution is given by the Owner, A/E, GC, or other Party as stipulated in the contracts governing the project.

# J. Construction Phase Training

- 1. Adequate and thorough training of the operators and the facilities staff is vital to effective transition and early occupancy of the building. A key goal of the Cx team is to ensure this is accomplished.
- 2. During the construction phase, the final details of the training shall be planned via the Training Plan submission and approval process.
- 3. Generally, the Equipment and Systems Training is covered in the Training Plan and specified in the construction documents. Other non-contractor training is covered in this plan.

- 4. All parties will be involved in the training process. Many of the documents created and gathered throughout the Cx process will be used in training. Detailed requirements for training are include in the construction specifications. Training will be conducted both on site an in a classroom setting as suits the subject matter.
- 5. All training shall include persistent documentation that will be handed out to all attendees as well as included electronically in the Training Plan. All sessions shall be evaluated by the attendees. The contractor will be responsible for videotaping the training sessions for later use assuming the budget for such has been allocated and deemed necessary by the Owner.

#### VIII. Acceptance Phase Cx Task Definitions

#### A. Execution of FPTs

1. Refer to Section 019114.

#### B. Acceptance Criteria

1. Acceptance criteria for tests are indicated in Section 019113, Section 019114, and other specification sections applicable to the systems being tested. Generally, unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device.

#### IX. Warranty Phase Cx Task Definitions

#### A. General

 The Warranty Phase will start upon initial Substantial Completion of the facility. Cx Activities continue throughout this period. These activities are defined in this section.

#### B. Warranty Work

- 1. At the start of the Warranty, contractor is responsible for servicing the equipment and responding to warranty calls. Generally, the logistics of how this work is initiated will be part of the management protocols discussed during the Construction Phase Kick off meeting. However, a typical scenario will be that the Owner will express any issues to Owner's Service and maintenance technicians who will be the first responders to the issue. The Owner's service and maintenance technicians shall make an initial diagnosis as to whether this is a Warranty issue.
- 2. Owner's technicians assess responsibility in good faith but bear no responsibility for misdiagnosis. GC must log all Warranty calls with a description of the issue, track the status of completion, then indicate how and when the issue was closed.

#### C. Opposite Season Testing

1. CxT shall conduct opposite season testing to check functionality of systems that could not be done within the Acceptance Phase if applicable. Perform functional performance testing for weather extreme related functionality. Review trending of BAS points to assess issues. Document all findings in the Cx Record.

<b>X.</b>	Appendix A. Prefunctional and Functional Performance Testing Documentation			

B-1 (HVAC\Project) Boiler

OK? Party: Initials:

1 Manufacturer's cut sheets and submittal data available	MC
2 Installation is per manufacturer's instructions	MC
3 Site sufficiently clean for testing	MC
4 Equipment labels affixed	MC
5 General appearance good, no apparent damage	MC
6 Pipes not supported on boiler; pipe isolated with spring hangers in sensitive areas as applicable.	MC
7 System filled	MC
8 Access and clearance for service and per code is provided.	MC
9 Multiple boiler interlocks completed	MC
10 Thermometers installed	MC
11 Pressure gages installed	MC
13 Safeties in place, checked and functional	MC
14 Manufacturer's start-up successfully completed and records submitted	MC
17 All level and safety controls installed, checked and functional	MC
18 Combustion air supply verified and adequate	MC
19 Control setpoints coordinated with the Owner	MC
20 Boiler passed inspection and inspection certificates are provided	MC
21 Vibration isolation installed correctly	MC
22 Flex connectors installed on water and gas connections.	MC
Combustion Gas Exhaust Piping -	
1 Installed per manufacturer's directions	MC
2 Properly sloped (slope toward drain point with min 1/4" per foot)	MC
3 Adequate clearance to combustibles	MC
4 Proper personnel protection provided to prevent burning hazard	MC
5 Discharge is protected from rain and blockage	MC
6 Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone	MC
7 Draft checked and appears adequate across firing range	MC
8 Connected to boiler per manufacturer's direction.	MC
9 Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any possible leakage of flue gas.	MC
10 Flue condensate drain is piped into drain as required by detail	MC
Combination Con Listal a Dinima	
Combustion Gas Intake Piping -	
Combustion Gas Intake Piping -  1 Installed per manufacturer's directions	MC
<u> </u>	MC MC

		OK?	Party:	Initials:
	5 Intake opening is protected from rain and blockage (screened inlet, above snow accumulation, etc.)		MC	
	6 Intake is located so as not to reentrain combustion gases.		MC	
	7 Draft checked and appears adequate across firing range.		MC	
	8 Connected to boiler per manufacturer's direction.		MC	
	9 Intake assembly extended to outside and sealed airtight to prevent contaminants from boiler room entering boiler.		MC	
В-1 Не	eating Source Burner - Low Water Cutoff - LWCO			
	2 Installed per manufacturer's instructions		MC	
	3 Wire terminations checked and correct		MC	
	4 Low water cutoff operation checked and documented elsewhere herein		MC	
В-1 Не	eating Source Gas Train -			
	1 Installed in accordance with NFPA/FM/IRI as applicable and specifications		MC	
	2 Gas Train is accessible for maintenance and clearances are maintained		MC	
	3 Checked the train for leaks and no leaks are present		MC	
	4 Vents are terminated per code and so as to not to cause a hazard		MC	
	5 All safety devices have been checked out and are operational as indicated by more specific tests herein		MC	
	6 Adequate drip leg provided in gas main		MC	
	7 Gas pressure is adequate at full load (with only this boiler operating and booster running)		MC	
B-1 He	eating Source Gas Train - Pressure Regulator (Gas) -			
	1 Valve orientation and installation per manufacturer's recommendations.		MC	
	2 Pressure adjusted and verified within acceptable range, specific values documented elsewhere herein.		MC	
	3 Vents are terminated per code and so as to not to cause a hazard.		MC	
B-1 H4	eating Source Gas Train - Valve (Gas Control) -			
- 111	1 Valve orientation per manufacturer's recommendations. Vertical and direction of flow was checked		MC	
	2 Valve accessible and travels freely		MC	
	3 Closed this valve and opened all other valves in the gas train and checked for leaks both through the seat		MC	
	and around the joints	]		
	4 No damage evident		MC	
	5 Checked the nameplate readings against application and valve is correctly applied		MC	
	6 Piping independently supported and not causing binding		MC	
	7 Strainer and/or filter installed upstream		MC	
	8 Range for minimum and maximum fire adjusted per the equipment being served. Refer to setting under associated equipment		MC	
	9 Integrity of enclosure maintained water and dust proof.		MC	

OV2	Doutru	Initialar	
OK?	Partv:	Initials:	

B-1 Hot V	Water Pump -		
1	Manufacturer's cut sheets and submittal data submitted and approved and correlates with the pump installed	i 🗌	MC
2	Installation per manufacturer's instructions		MC
3	Label permanently affixed		MC
5	Vibration isolation devices installed and functional. Vibration isolation free and floating. Vibration restraints are in place.		MC
8	Temperature, pressure and flow gages and sensors installed		MC
9	Pump lubricated. Grease prime and oil levels checked. Lubricants coordinated with manufacturer's requirements and Owner. On oil-lubricated, enclosed lineshaft units, ensure that the oil tank is completely full and allow the oil to drip overnight prior to start-up. Check the solenoid valve and its connection for proper operation. Refill the oil tank.		MC
11	Isolation valves and piping specialties installed		MC
12	Pump turns freely		MC
15	Insulation installed per requirements. Pumps for cold water insulated to avoid condensation yet allow service.		MC
16	Pump detail checked against the drawings and all devices gages and appurtenances are in place.		MC
1	Water Pump - Motor (Elec) -  Installation per manufacturer's instructions  Motor correctly aligned		MC MC
D 1 Ha4 I	Water Delief Value		
	Water Relief Valve -		) (G
	Installation per manufacturer's instructions		MC
	Discharge piped to a safe and proper location		MC
	Rating and Setting is per design specs		MC
	Located where it can not be isolated		MC
5	Actuation Tested and found acceptable	$\sqcup$	MC

	OK?	Party: In	nitials:
B-1 Outside Air Damper -			
Damper linkage tight with minimal play		MC	
2 Damper travels freely across range [backdraft dampers operate freely where applicable]		MC	
3 Access panels installed where applicable		MC	
4 Manufacturer's cut sheets and submittal data available		MC	
5 Installation per manufacturer's instructions		MC	

OK?	Party:	Initials:

B-2 (HVAC\Project) Boiler

<b>B-2</b>			
	1	Manufacturer's cut sheets and submittal data available	MC
	2	Installation is per manufacturer's instructions	MC
	3	Site sufficiently clean for testing	MC
	4	Equipment labels affixed	MC
	5	General appearance good, no apparent damage	MC
	6	Pipes not supported on boiler; pipe isolated with spring hangers in sensitive areas as applicable.	MC
	7	System filled	MC
	8	Access and clearance for service and per code is provided.	MC
	9	Multiple boiler interlocks completed	MC
	10	Thermometers installed	MC
	11	Pressure gages installed	MC
	13	Safeties in place, checked and functional	MC
	14	Manufacturer's start-up successfully completed and records submitted	MC
	17	All level and safety controls installed, checked and functional	MC
	18	Combustion air supply verified and adequate	MC
	19	Control setpoints coordinated with the Owner	MC
	20	Boiler passed inspection and inspection certificates are provided	MC
	21	Vibration isolation installed correctly	MC
	22	Flex connectors installed on water and gas connections.	MC
B-2 (	Comi	bustion Gas Exhaust Piping -	
		Installed per manufacturer's directions	MC
		Properly sloped (slope toward drain point with min 1/4" per foot)	MC
		Adequate clearance to combustibles	MC
	4	Proper personnel protection provided to prevent burning hazard	MC
	5	Discharge is protected from rain and blockage	MC
	6	Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone	MC
	7	Draft checked and appears adequate across firing range	MC
		Connected to boiler per manufacturer's direction.	MC
	9	Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any possible leakage of flue gas.	MC
	10	Flue condensate drain is piped into drain as required by detail	MC
B-2 (		bustion Gas Intake Piping -	
	1	Installed per manufacturer's directions	MC
	2	Properly sloped (slope toward unit with min 1/4" per foot)	MC
	3	Adequate clearance to combustibles	MC

	OK?	Party:	Initials:
5 Intake opening is protected from rain and blockage (screened inlet, above snow accumulation, etc.)		MC	
6 Intake is located so as not to reentrain combustion gases.		MC	
7 Draft checked and appears adequate across firing range.		MC	
8 Connected to boiler per manufacturer's direction.		MC	
9 Intake assembly extended to outside and sealed airtight to prevent contaminants from boiler room entering	. 🗆	MC	
boiler.	, —		
B-2 Heating Source Burner - Low Water Cutoff - LWCO		MC	
2 Installed per manufacturer's instructions		MC	
3 Wire terminations checked and correct		MC	
4 Low water cutoff operation checked and documented elsewhere herein		MC	
B-2 Heating Source Gas Train -			
1 Installed in accordance with NFPA/FM/IRI as applicable and specifications		MC	
2 Gas Train is accessible for maintenance and clearances are maintained		MC	
3 Checked the train for leaks and no leaks are present		MC	
4 Vents are terminated per code and so as to not to cause a hazard		MC	
5 All safety devices have been checked out and are operational as indicated by more specific tests herein		MC	
6 Adequate drip leg provided in gas main		MC	
7 Gas pressure is adequate at full load (with only this boiler operating and booster running)		MC	
B-2 Heating Source Gas Train - Pressure Regulator (Gas) -		140	
1 Valve orientation and installation per manufacturer's recommendations.		MC	
2 Pressure adjusted and verified within acceptable range, specific values documented elsewhere herein.		MC	
3 Vents are terminated per code and so as to not to cause a hazard.		MC	
B-2 Heating Source Gas Train - Valve (Gas Control) -			
1 Valve orientation per manufacturer's recommendations. Vertical and direction of flow was checked		MC	
2 Valve accessible and travels freely		MC	
3 Closed this valve and opened all other valves in the gas train and checked for leaks both through the seat and around the joints		MC	
4 No damage evident		MC	
5 Checked the nameplate readings against application and valve is correctly applied		MC	
6 Piping independently supported and not causing binding		MC	
7 Strainer and/or filter installed upstream		MC	
8 Range for minimum and maximum fire adjusted per the equipment being served. Refer to setting under		MC	
associated equipment			
9 Integrity of enclosure maintained water and dust proof.		MC	

OV2	Doutru	Initialar	
OK?	Partv:	Initials:	

B-2 Hot V	Vater Pump -		
1	Manufacturer's cut sheets and submittal data submitted and approved and correlates with the pump installed	d 🗌	MC
2	Installation per manufacturer's instructions		MC
3	Label permanently affixed		MC
5	Vibration isolation devices installed and functional. Vibration isolation free and floating. Vibration restraints are in place.		MC
8	Temperature, pressure and flow gages and sensors installed		MC
9	Pump lubricated. Grease prime and oil levels checked. Lubricants coordinated with manufacturer's requirements and Owner. On oil-lubricated, enclosed lineshaft units, ensure that the oil tank is completely full and allow the oil to drip overnight prior to start-up. Check the solenoid valve and its connection for proper operation. Refill the oil tank.		MC
11	Isolation valves and piping specialties installed		MC
12	Pump turns freely		MC
15	Insulation installed per requirements. Pumps for cold water insulated to avoid condensation yet allow service.		MC
16	Pump detail checked against the drawings and all devices gages and appurtenances are in place.		MC
1	Water Pump - Motor (Elec) -  Installation per manufacturer's instructions  Motor correctly aligned		MC MC
R_2 Hot I	Vater Relief Valve -		
	Installation per manufacturer's instructions		MC
	Discharge piped to a safe and proper location		MC MC
	Rating and Setting is per design specs		MC MC
	Located where it can not be isolated		MC MC
	Actuation Tested and found acceptable		MC MC
3	Actuation residu and found acceptable		IVIC

	OK?	Party: I	Initials:
B-2 Outside Air Damper -			
1 Damper linkage tight with minimal play		MC	
2 Damper travels freely across range [backdraft dampers operate freely where applicable]		MC	
3 Access panels installed where applicable		MC	
4 Manufacturer's cut sheets and submittal data available		MC	
5 Installation per manufacturer's instructions		MC	

OK?	Party:	Initials:

B-3 (HVAC\Project) Boiler

1	Manufacturer's cut sheets and submittal data available	MC	
2	Installation is per manufacturer's instructions	MC	
3	Site sufficiently clean for testing	MC	
4	Equipment labels affixed	MC	
5	General appearance good, no apparent damage	MC	
6	Pipes not supported on boiler; pipe isolated with spring hangers in sensitive areas as applicable.	MC	
7	System filled	MC	
8	Access and clearance for service and per code is provided.	MC	
9	Multiple boiler interlocks completed	MC	
10	Thermometers installed	MC	
11	Pressure gages installed	MC	
13	Safeties in place, checked and functional	MC	
14	Manufacturer's start-up successfully completed and records submitted	MC	
17	All level and safety controls installed, checked and functional	MC	
18	Combustion air supply verified and adequate	MC	
19	Control setpoints coordinated with the Owner	MC	
20	Boiler passed inspection and inspection certificates are provided	MC	
21	Vibration isolation installed correctly	MC	
22	Flex connectors installed on water and gas connections.	MC	
R-3 Comb	oustion Gas Exhaust Pining -		
	bustion Gas Exhaust Piping -	MC	
1	Installed per manufacturer's directions	MC MC	
1 2	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot)	MC	
1 2 3	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot) Adequate clearance to combustibles	MC MC	
1 2 3 4	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot) Adequate clearance to combustibles Proper personnel protection provided to prevent burning hazard	MC MC MC	
1 2 3 4 5	Installed per manufacturer's directions  Properly sloped (slope toward drain point with min 1/4" per foot)  Adequate clearance to combustibles  Proper personnel protection provided to prevent burning hazard  Discharge is protected from rain and blockage	MC MC MC MC	
1 2 3 4 5 6	Installed per manufacturer's directions  Properly sloped (slope toward drain point with min 1/4" per foot)  Adequate clearance to combustibles  Proper personnel protection provided to prevent burning hazard  Discharge is protected from rain and blockage  Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone	MC MC MC MC MC	
1 2 3 4 5 6 7	Installed per manufacturer's directions  Properly sloped (slope toward drain point with min 1/4" per foot)  Adequate clearance to combustibles  Proper personnel protection provided to prevent burning hazard  Discharge is protected from rain and blockage  Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone  Draft checked and appears adequate across firing range	MC MC MC MC MC MC	
1 2 3 4 5 6 7 8	Installed per manufacturer's directions  Properly sloped (slope toward drain point with min 1/4" per foot)  Adequate clearance to combustibles  Proper personnel protection provided to prevent burning hazard  Discharge is protected from rain and blockage  Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone  Draft checked and appears adequate across firing range  Connected to boiler per manufacturer's direction.  Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any	MC MC MC MC MC	
1 2 3 4 5 6 7 8	Installed per manufacturer's directions  Properly sloped (slope toward drain point with min 1/4" per foot)  Adequate clearance to combustibles  Proper personnel protection provided to prevent burning hazard  Discharge is protected from rain and blockage  Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone  Draft checked and appears adequate across firing range  Connected to boiler per manufacturer's direction.	MC MC MC MC MC MC MC	
1 2 3 4 5 6 7 8	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot) Adequate clearance to combustibles Proper personnel protection provided to prevent burning hazard Discharge is protected from rain and blockage Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone Draft checked and appears adequate across firing range Connected to boiler per manufacturer's direction.  Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any possible leakage of flue gas.	MC MC MC MC MC MC MC MC MC	
1 2 3 4 5 6 7 8 9	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot) Adequate clearance to combustibles Proper personnel protection provided to prevent burning hazard Discharge is protected from rain and blockage Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone Draft checked and appears adequate across firing range Connected to boiler per manufacturer's direction. Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any possible leakage of flue gas. Flue condensate drain is piped into drain as required by detail	MC MC MC MC MC MC MC MC MC	
1 2 3 4 5 6 6 7 8 9 10 <b>B-3 Comb</b>	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot) Adequate clearance to combustibles Proper personnel protection provided to prevent burning hazard Discharge is protected from rain and blockage Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone Draft checked and appears adequate across firing range Connected to boiler per manufacturer's direction.  Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any possible leakage of flue gas.  Flue condensate drain is piped into drain as required by detail	MC MC MC MC MC MC MC MC MC	
1 2 3 4 5 6 6 7 8 9 10 <b>B-3 Comb</b>	Installed per manufacturer's directions Properly sloped (slope toward drain point with min 1/4" per foot) Adequate clearance to combustibles Proper personnel protection provided to prevent burning hazard Discharge is protected from rain and blockage Discharge is located so as not to reentrain combustion gases into intakes or into a breathing zone Draft checked and appears adequate across firing range Connected to boiler per manufacturer's direction. Exhaust assembly extended to outside and sealed airtight with high temperature sealant to prevent any possible leakage of flue gas. Flue condensate drain is piped into drain as required by detail	MC	

		OK?	Party:	Initials:
	5 Intake opening is protected from rain and blockage (screened inlet, above snow accumulation, etc.)		MC	
	6 Intake is located so as not to reentrain combustion gases.		MC	
	7 Draft checked and appears adequate across firing range.		MC	
	8 Connected to boiler per manufacturer's direction.		MC	
	9 Intake assembly extended to outside and sealed airtight to prevent contaminants from boiler room entering boiler.		MC	
В-3 Н	ating Source Burner - Low Water Cutoff - LWCO			
2 0 11	2 Installed per manufacturer's instructions		MC	
	3 Wire terminations checked and correct		MC	
	4 Low water cutoff operation checked and documented elsewhere herein		MC	
В-3 Н	ating Source Gas Train -			
	Installed in accordance with NFPA/FM/IRI as applicable and specifications		MC	
	2 Gas Train is accessible for maintenance and clearances are maintained		MC	
	3 Checked the train for leaks and no leaks are present		MC	
	4 Vents are terminated per code and so as to not to cause a hazard		MC	
	5 All safety devices have been checked out and are operational as indicated by more specific tests herein		MC	
	6 Adequate drip leg provided in gas main		MC	
	7 Gas pressure is adequate at full load (with only this boiler operating and booster running)		MC	
B-3 H	ating Source Gas Train - Pressure Regulator (Gas) -			
	1 Valve orientation and installation per manufacturer's recommendations.		MC	
	2 Pressure adjusted and verified within acceptable range, specific values documented elsewhere herein.		MC	
	3 Vents are terminated per code and so as to not to cause a hazard.		MC	
B-3 H	ating Source Gas Train - Valve (Gas Control) -			
	1 Valve orientation per manufacturer's recommendations. Vertical and direction of flow was checked		MC	
	2 Valve accessible and travels freely		MC	
	3 Closed this valve and opened all other valves in the gas train and checked for leaks both through the seat and around the joints		MC	
	4 No damage evident		MC	
	5 Checked the nameplate readings against application and valve is correctly applied		MC	
	6 Piping independently supported and not causing binding		MC	
	7 Strainer and/or filter installed upstream		MC	
	8 Range for minimum and maximum fire adjusted per the equipment being served. Refer to setting under associated equipment		MC	
	9 Integrity of enclosure maintained water and dust proof.		MC	

OV2	D	T., 141 - 1	
OK?	Partv:	Initials:	

B-3 Hot V	Vater Pump -		
1	Manufacturer's cut sheets and submittal data submitted and approved and correlates with the pump installed	<u> </u>	MC
2	Installation per manufacturer's instructions		MC
3	Label permanently affixed		MC
5	Vibration isolation devices installed and functional. Vibration isolation free and floating. Vibration restraints are in place.		MC
8	Temperature, pressure and flow gages and sensors installed		MC
9	Pump lubricated. Grease prime and oil levels checked. Lubricants coordinated with manufacturer's requirements and Owner. On oil-lubricated, enclosed lineshaft units, ensure that the oil tank is completely full and allow the oil to drip overnight prior to start-up. Check the solenoid valve and its connection for proper operation. Refill the oil tank.		MC
11	Isolation valves and piping specialties installed		MC
12	Pump turns freely		MC
15	Insulation installed per requirements. Pumps for cold water insulated to avoid condensation yet allow service.		MC
16	Pump detail checked against the drawings and all devices gages and appurtenances are in place.		MC
1	Water Pump - Motor (Elec) -  Installation per manufacturer's instructions  Motor correctly aligned		MC MC
R 2 Hot I	Vater Relief Valve -		
	Installation per manufacturer's instructions		MC
	Discharge piped to a safe and proper location		MC MC
			MC MC
	Rating and Setting is per design specs  Located where it can not be isolated		MC MC
			MC MC
3	Actuation Tested and found acceptable		IVIC

	OK?	Party: Init	tials:
B-3 Outside Air Damper -			
1 Damper linkage tight with minimal play		MC	
2 Damper travels freely across range [backdraft dampers operate freely where applicable]		MC	
3 Access panels installed where applicable		MC	
4 Manufacturer's cut sheets and submittal data available		MC	
5 Installation per manufacturer's instructions		MC	

(HVAC\Project) Operating Sequences

Boiler Sys	tem	
1	Manufacturer's cut sheets and submittal data available	MC
2	Installation is per manufacturer's instructions	MC
3	Site sufficiently clean for testing	MC
4	Equipment labels affixed	MC
5	General appearance good, no apparent damage	MC
6	Pipes not supported on boiler; pipe isolated with spring hangers in sensitive areas as applicable.	MC
7	System filled	MC
8	Access and clearance for service and per code is provided.	MC
9	Multiple boiler interlocks completed	MC
10	Thermometers installed	MC
11	Pressure gages installed	MC
13	Safeties in place, checked and functional	MC
14	Manufacturer's start-up successfully completed and records submitted	MC
17	All level and safety controls installed, checked and functional	MC
18	Combustion air supply verified and adequate	MC
19	Control setpoints coordinated with the Owner	MC
20	Boiler passed inspection and inspection certificates are provided	MC
21	Vibration isolation installed correctly	MC
22	Flex connectors installed on water and gas connections.	MC

	OK?	Party:	Initials:
3-1		(HVAC\P	roject) Boiler
reFunctional Procedures			
B-1 Hot Water Pump - Motor (Elec) -			
2 Rotates in the correct direction		EC	
3 Starter Installed and size coordinated with motor		EC	
4 Electrical connections complete		EC	
5 Disconnect switch installed		EC	
6 Overloads in place and are correct size		EC	

EC

EC EC

7 The disconnect switch properly operates

10 Voltage applied is matched with motor rating

9 Terminations tight

B-1 Unit Elec Connection - EC -		
1 Reviewed Mftrs field wiring diagrams and validated Conformance	EC	
2 Checked available supply Voltage and verified that it is in range of the equipment rating	EC	
3 Checked the setting of installed overload protection and compared it against manufacturer's rating	EC	
4 Coordinated disconnection devices with that provided by the manufacturer	EC	
5 Verified terminations tight and installed per manufacturer's instructions	EC	
6 Check the parameters on the incoming electrical power. Ensured imbalance is within requirements and FLA is below rating.	EC	

	OK?	Party:	Initials:
3-2	(	HVAC\Pi	roject) Boiler
raFunctional Procedures			

reFun	ctional Procedures		
B-2 Hot	Water Pump - Motor (Elec) -		
2	Rotates in the correct direction	EC	
3	Starter Installed and size coordinated with motor	EC	
4	Electrical connections complete	EC	
5	Disconnect switch installed	EC	
6	Overloads in place and are correct size	EC	
7	The disconnect switch properly operates	EC	
9	Terminations tight	EC	
10	Voltage applied is matched with motor rating	EC	
B-2 Unit	Elec Connection - EC -		
1	Reviewed Mftrs field wiring diagrams and validated Conformance	EC	
2	Checked available supply Voltage and verified that it is in range of the equipment rating	EC	
3	Checked the setting of installed overload protection and compared it against manufacturer's rating	EC	
4	Coordinated disconnection devices with that provided by the manufacturer	EC	
5	Verified terminations tight and installed per manufacturer's instructions	EC	
6	Check the parameters on the incoming electrical power. Ensured imbalance is within requirements and FLA is below rating.	EC	

	OK?	Party:	Initials:
3-3		(HVAC\P	roject) Boiler
reFunctional Procedures			
B-3 Hot Water Pump - Motor (Elec) -			
2 Rotates in the correct direction		EC	
3 Starter Installed and size coordinated with motor		EC	
4 Electrical connections complete		EC	
5 Disconnect switch installed		EC	
6 Overloads in place and are correct size		EC	
7 The disconnect switch properly operates		EC	

9 Terminations tight

10 Voltage applied is matched with motor rating

EC EC

B-3 Unit Elec Connection - EC -		
1 Reviewed Mftrs field wiring diagrams and validated Conformance	EC	
2 Checked available supply Voltage and verified that it is in range of the equipment rating	EC	
3 Checked the setting of installed overload protection and compared it against manufacturer's rating	EC	
4 Coordinated disconnection devices with that provided by the manufacturer	EC	
5 Verified terminations tight and installed per manufacturer's instructions	EC	
6 Check the parameters on the incoming electrical power. Ensured imbalance is within requirements and FLA is below rating.	EC	

Hot Water Supply Pipe - HWS Temp Sensor - B-1	
1 Installation per manufacturer's instructions	☐ ATC
2 Confirm sensor not affected by other thermal influences	ATC ATC
3 Point to point done	ATC ATC
4 Device accessible	ATC ATC
5 Check sensed value at single point of operation versus calibrated instrument.	ATC
Hot Water Supply Pipe - HWS Temp Sensor - B-2	
1 Installation per manufacturer's instructions	ATC
2 Confirm sensor not affected by other thermal influences	ATC ATC
3 Point to point done	ATC ATC
4 Device accessible	ATC ATC
5 Check sensed value at single point of operation versus calibrated instrument.	ATC ATC
- Chest consect that we single point of operation to come suite and an extra suite and an	
Hot Water Supply Pipe - HWS Temp Sensor - B-3	
1 Installation per manufacturer's instructions	☐ ATC
2 Confirm sensor not affected by other thermal influences	ATC
3 Point to point done	ATC ATC
4 Device accessible	ATC ATC
5 Check sensed value at single point of operation versus calibrated instrument.	ATC
Hot Water Supply Pipe - HWS Temp Sensor - HWS	
1 Installation per manufacturer's instructions	☐ ATC
2 Confirm sensor not affected by other thermal influences	ATC ATC
3 Point to point done	ATC ATC
4 Device accessible	ATC ATC
5 Check sensed value at single point of operation versus calibrated instrument.	☐ ATC —
Hot Water Return Pipe - HWR Temp Sensor - HWR	
1 Installation per manufacturer's instructions	☐ ATC
2 Confirm sensor not affected by other thermal influences	☐ ATC
3 Point to point done	□ ATC
4 Device accessible	ATC
5 Check sensed value at single point of operation versus calibrated instrument.	☐ ATC
Boiler Outside Air Damper - Actuator -	
1 Installation per manufacturer's instructions	ATC
2 Mounted correctly and Linkage tight travels freely	ATC
3 Inspect damper seals, blades, and linkage. Command damper closed. Check actual close-off and feedback if applicable. Command damper open. Check actual full stroke and feedback where applicable.	ATC
4 Indicating gauges installed and adjusted	ATC

	OK?	Party:	Initials:
Hot Water Boiler, Unit Heaters & Supply Fan			
<b>PreFunctional Procedures</b>			
TAB completed and submitted with no anomalies		TAB	
Hot Water Flow Meters  Checked sensor at multiple points across widest range obtainable. Coordinate calibration of device and reading on BAS with TAB.		TAB	

Start							
	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
1		Graphic - Setup	zy_Prefunctional	Tests		BAS graphic was acceptable. All points were validated.	Didn't Test
ATC	Test Des	cription		-			
AIC	assignme	graphic for accuracy, q nt. For inputs manipula om graphic and obsesrve	te sensor to vaildate gr	aphic update. For			
2		Graphic - Setpoints	zy_Prefunctional	Tests		All setpoints are adjustable (none in code).	Didn't Test
ATC	Test Des	cription		-			
7.1.0		that the setpoints require graphic and/or a function		r the sequence can	be changed directly		
9		z_Loop Response / Sequence	zy_Prefunctional	Tests		Control loops responded acceptably. Action correct for application and normal positions of controlled devices.	Didn't Test
ATC	Test Des	cription		-			
AIC	Verified a	ill sequences work:					
	Inve Boil BAC Boil CO	ip: Boilers B-1,2,3, Pun rse rest schedule HW er Loop shall enable Con Net MC/TP er/Pump selected, alternation Monitoring at each boiler room exit	ntroller when in Heatin		n proved by DP with a	larm	

Start	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
1 ATC	assignme	Graphic - Setup eription graphic for accuracy, q nt. For inputs manipula om graphic and obsessive	te sensor to vaildate gr	raphic update. For o	points for proper outputs, command	BAS graphic was acceptable. All points were validated.	Didn't Test
2 ATC		Graphic - Setpoints eription that the setpoints requiregraphic and/or a function	red to be adjustable pe	Tests - er the sequence can l	be changed directly	All setpoints are adjustable (none in code).	Didn't Test
3 ATC	Test Desc Send 'Sto	Equip - S/S Feedback eription p' and 'Start' Commands	-	Tests - displayed status at (	OI.	'Stop' and 'Start' states displayed on workstation matched command and actual status.	Didn't Test
4 ATC	equipmer	Equip Interlock cription rogramming and configut is not operationally or iquipment operation.				Equipment interlock in place to prevent operation of equipment, and/or verify all applicable equipment is interlocked and running.	Didn't Test
5 ATC		Equip - Power Interrupt eription pted power to the unit [seed power to the unit by ]				A. All devices go to their fail position. Unit stops. [Panel clock keeps correct time/date.] [Interlocked equipment responds per specification].  B. Unit restarts and enters correct operational mode.	Didn't Test
6 ATC		Equip - Alarm cription aipment/unit to go into a proper enunciation in th		Tests - concert with other t	failure tests. This test	Alarm enunciated locally at the control panel, and at the BAS Operator Interface.	Didn't Test

Start	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
8 ATC	Test Describer Set up all a archive for	applicable individual tr	zy_Prefunctional rends and trend logs (n	Tests - nulitple associated po	pints). Establish	All trends and trend logs set up per plans and specs.	Didn't Test
9 ATC	A. General B. Pump C C. Boiler S D. Boiler S E. Alternat F. Lead Bo G. HW Res H. Parallel I Boiler HV J. Alarms	Control Startup Shutdown ing Boiler Assignment oller set ling Boilers W Temp Alarms  OC point configuration		Tests -		Control loops responded acceptably. Action correct for application and normal positions of controlled devices.	Didn't Test

Installation Checklists	OK? Party: Initials:
UH (typ)	
1 Manufacturer's cut sheets and submittal data available	□ мс
2 Installation is per manufacturer's instructions	
3 Labeling affixed on unit	
4 Casing condition good: no dents, leaks	
5 Vibration isolation equipment installed & shipping blocks removed	
6 Thermal insulation properly installed	
7 Filters installed and replaced	
8 Maintenance access acceptable for unit and components	
9 Unit has been thoroughly cleaned	□ MC
UH (typ) Heating Air Coil -	
1 Pipes properly labeled	☐ MC
2 Pipes properly insulated	☐ MC
3 No leaking apparent around fittings	$\square$ MC
4 All coils are clean, combed and fins are in good condition	$\square$ MC
5 Isolation valves installed correctly, travel freely and close tightly	$\square$ MC
6 TAB report is available with no abnormalities	TAB
UH (typ) Heating Air Control Valve -	
Adequate maintenance clearance is provided and valve is accessible	☐ MC
2 Valve travels freely through full range	☐ MC
3 Valve closes off and seals tightly	MC MC
4 Unions installed to allow easy removal	
UH (typ) Supply Air Fan -	
1 Casing condition good: no dents	☐ MC
2 Fans rotate freely	
3 Fan rotation correct	MC
UH (typ) Supply Air Fan - Motor (Elec) Mtr	
1 Rotates in the correct direction	EC
2 Electrical connnections complete	EC EC
3 The disconnect switch properly operates	EC EC
4 Terminations tight	□ EC
UH (typ) Zone Air Space Rm Temp Sensor TS1	
1 Installation per manufacturer's instructions	☐ ATC
2 Confirm sensor not affected by other thermal influences	☐ ATC
3 wired correctly	☐ ATC
4 Device accessible	□ ATC

UH (typ)

Start							
	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
1		Graphic - Setpoints	zy_Prefunctional	Tests		All setpoints are adjustable (none in code).	Didn't Test
ATC	Test Descr	ription		-			
AIC	Validated from the g	that the setpoints requireraphic and/or a function	red to be adjustable pen block menu.	r the sequence can b	be changed directly		
2		Graphic - Setup	zy_Prefunctional	Tests		FMS graphic was acceptable.	Didn't Test
A.T.C.	Test Descr	ription		-			
ATC	assignmen	graphic for accuracy, q t. For inputs manipulat m graphic and obsessive	te sensor to vaildate gr	raphic update. For o	points for proper outputs, command		
3		Equip - S/S Feedback	zy_Prefunctional	Tests		'Stop' and 'Start' states displayed on workstation matched command and actual status.	Didn't Test
ATC	Test Descr	ription		-			
4		Equip - Power Interupt	zy_Prefunctional	Tests		A. All devices go to their fail position. Unit stops. [Panel clock keeps correct time/date.] [Interlocked equipment responds per specification].	Didn't Test
4.70	Test Descr	ription		-		D. Unit vestants and entare connect expectional mode	
ATC	A. Interrup	oted power to the unit [s	system] by [opening th	ne disconnect.] [tripp	ping the breaker.]	B. Unit restarts and enters correct operational mode.	
	B. Restore	d power to the unit by	closing the disconnect	.] [resetting the brea	ker.]		
5		Equip - Alarm	zy_Prefunctional	Tests		Alarm enunciated locally at the control panel, and at BAS Operator Interfaces.	Didn't Test
ATC	Test Descr	ription		-			
AIO		ipment/unit to go into a proper enunciation in the		concert with other fa	ailure tests. This test		
6		Trends	zy_Prefunctional	Tests		All trends and trend logs set up per plans and specs.	Didn't Test
ATC	Test Descr	•		-			
	Set up all a archive for	applicable individual tro r trends.	ends and trend logs (m	nulitple associated po	oints). Establish		

UH (ty	p)						(typ)
Start	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
7		z_Loop Response - Sequences	zy_Prefunctional	Tests		Loop responded acceptably. Action correct for application and normal positions of controlled devices. Control reasonbly stable, loop maintained setpoint.	Didn't Test
ATC	Test Des Verified	cription all sequences work includ	ling but not limited to	- o:			
	A. DDC o B. Wall r C. Coord D. I/O Po	nounted temp sensor inate					
FPT	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
101 CA	Test Des Checked complian	the configuration. Review	zz_Control wed it against the con	Sequences - ntract documents and e	nsured its	Installation is per the contract documents.	Didn't Test
102 CA	Document Review zz_Control Sequences  Test Description -  Verified the required documents have been submitted and reviewed them to ensure adequacy. Ensured all data for all components involved with test are included. Verified that linked electronic reports/test results include accurate component designations that match those used on the contract documents and include a method to directly navigate to specific components such as hyperlinks, bookmarks, table of contents with accurate page numbering, etc.					1. Approved Submittals/Shop Dwgs: Yes 2. Operations and Maintenance Data: Yes 3. Completed Start Up Checklists and Tests: Yes 4. Warranty Information: Yes	Didn't Test
103 CA		Prerequisite - AHU cription It that all supporting and/o		Sequences - re been started and test	ed to the extent	All systems ready; including: Electrical Distribution, Ductwork, Air TAB, Related Piping Systems including {customize per system}, Water TAB, Control Systems. All labeling affixed and adequate access is provided to all components.	Didn't Test

**Test Description** 

104

CA

Start Up Review

zz\_Control

Reviewed the start up documentation and the prefunctional checklists.

Sequences

Start up was adequate.

Didn't Test

UH (typ)

(typ)

	Date	Type of Test	Function	Component	Device	<b>Expected/Final Results</b>	Status
105	Test Descri	Graphic - Setup	zz_Control	Sequences		FMS graphic was acceptable.	Didn't Test
CA	assignment.	raphic for accuracy, qua For inputs manipulate graphic and obsesrve a	sensor to vaildate	graphic update. For ou	pints for proper atputs, command		
106	Test Descri	Graphic - Setpoints	zz_Control	Sequences		All setpoints are adjustable (none in code).	Didn't Test
CA		at the setpoints required phic and/or a function l		er the sequence can be	changed directly		
107	Test Descri	Equip - S/S Feedback	zz_Control	Sequences		'Stop' and 'Start' states displayed on workstation matched command and actual status.	Didn't Test
CA		and 'Start' Commands.	Observe actual and	displayed status at OI			
108	Test Descri	Equip Interlock	zz_Control	Sequences		Equipment interlock in place to prevent operation of equipment, and/or verify all applicable equipment is interlocked and running.	Didn't Test
CA	equipment i	gramming and configures not operationaly or in pment operation.					
109		Equip - Power Interupt	zz_Control	Sequences		A. All devices go to their fail position. Unit stops. [Panel clock keeps correct time/date.] [Interlocked equipment responds per specification].	Didn't Test
CA	Test Descri A. Interrupt	<b>ption</b> ed power to the unit [sy	estem] by [opening	- the disconnect.] [trippi	ng the breaker.]	B. Unit restarts and enters correct operational mode.	
	B. Restored	power to the unit by clo	osing the disconnec	et.] [resetting the break	er.]		
110	Test Descri	Equip - Alarm	zz_Control	Sequences -		Alarm enunciated locally at the control panel, and at BAS Operator Interfaces.	Didn't Test
	- Cot D Cotti	P					

UH (typ) (typ)

	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
111		Steady-State Operation	zz_Control	Sequences		All control loops and functions operating normally per spec.  Date/Time:	Didn't Test
CA	Test Descr	ription		-			
CA	Observe sy parameters	estem in operation before	e making any chang	es. Recorded key syst	tem operating		
112		Training Sign Off	zz_Control	Sequences		Training Conducted. Attendees were as required.	Didn't Test
CA	Test Descr	•		-		Documentation of the course provided.	
	Validated that the training on all equipment and systems related to this FPT has been conducted, was acceptable, was attended by required Owner personnel, is adequately documented						
113		z_Loop Response - Sequences	zz_Control	Sequences		Loop responded acceptably. Action correct for application and normal positions of controlled devices. Control reasonbly stable, loop maintained setpoint.	Didn't Test
0.4	Test Descr	ription		-			
CA	Verified al	l sequences work includi	ing but not limited t	o:			
	A. DDC C	ontrols					
		ounted temp sensor					
	C. Coordir D. I/O Poi						

FPT	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status					
101	Date	Configuration Check	zz Control	Sequences	Device	Installation is per the contract documents.	Didn't Test					
101	Test Des		ZZ_Collubi	-		Installation is per the contract accuments.	Didn't Test					
CA	Checked	Checked the configuration. Reviewed it against the contract documents and ensured its compliance.										
102		Document Review	zz_Control	Sequences		1. Approved Submittals/Shop Dwgs: Yes	Didn't Test					
CA	Test Des	•		-		<ol> <li>Operations and Maintenance Data: Yes</li> <li>Completed Start Up Checklists and Tests: Yes</li> </ol>						
O.C.	Ensured a electronic the contra	the required documents had data for all components reports/test results included documents and included s, bookmarks, table of control of the requirements and include the requirements and include the requirements and include the requirements are required to the requirements and include the requirements are requirements.	involved with test e accurate compon a method to direct	are included. Verified ent designations that m ly navigate to specific	that linked natch those used on	4. Warranty Information: Yes						
103		Prerequisite - Hydronic	zz_Control	Sequences		All systems ready; including: Electrical Distribution, Related Piping Systems including, Water TAB, Control Systems. All	Didn't Test					
CA	Test Description - labeling affixed and adequate access is provided to all components.											
CA		that all supporting and/or for FPTs on this system.	related systems ha	ve been started and tes	sted to the extent							
104	T. (D.	Start Up Review	zz_Control	Sequences		Start up was adequate.	Didn't Test					
CA	Test Des	•	1.1 6	<del>-</del>			-					
	Reviewed	I the start up documentation	on and the prefunct	onal checklists.								
105	T. (D.	Graphic - Setup	zz_Control	Sequences		BAS graphic was acceptable. All points were validated.	Didn't Test					
CA	assignme	I graphic for accuracy, qua nt. For inputs manipulate om graphic and obsesrve ac	sensor to vaildate	graphic update. For ou	pints for proper stputs, command							
106	Test Des	Graphic - Setpoints	zz_Control	Sequences		All setpoints are adjustable (none in code).	Didn't Test					
CA	Validated	I that the setpoints required graphic and/or a function b		er the sequence can be	changed directly							

FPT										
	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status			
107		Equip - S/S Feedback	zz_Control	Sequences		'Stop' and 'Start' states displayed on workstation matched command and actual status.	Didn't Test			
CA	Test Descri		Observa actual and	dieplayed status at OI						
	Send 'Stop' and 'Start' Commands. Observe actual and displayed status at OI.									
108		Equip Interlock	zz_Control	Sequences		Equipment interlock in place to prevent operation of equipment, and/or verify all applicable	Didn't Test			
CA	Test Descri	_		-		equipment is interlocked and running.				
	equipment i	gramming and configure is not operationaly or in ipment operation.								
109		Equip - Power Interrupt	zz_Control	Sequences		A. All devices go to their fail position. Unit stops. [Panel clock keeps correct time/date.] [Interlocked equipment responds per specification].	Didn't Test			
CA	Test Descri	•		-		B. Unit restarts and enters correct operational mode.				
0/1	A. Interrupted power to the unit [system] by [opening the disconnect.] [tripping the breaker.]									
	B. Restored	power to the unit by [cl	osing the disconne	ct.] [resetting the break	ker.]					
110		Equip - Alarm	zz_Control	Sequences		Alarm enunciated locally at the control panel, and at the BAS Operator Interface.	Didn't Test			
CA	Test Descri	-		-						
		oment/unit to go into ala oper enunciation in the o		concert with other fai	ilure tests. This test					
111		Safety Seqs	zz_Control	Sequences		All devices set and tripped appropriately.	Didn't Test			
CA	Test Descri	•		-						
0,1	Verified all	relevant safeties are fun	ctioning properly							
112		Steady-State Operation	zz_Control	Sequences		All control loops and functions operating normally per spec. Date/Time:	Didn't Test			
CA	Test Descri	ption		-						
OA .	Observe sys parameters.	tem in operation before	making any change	es. Recorded key syste	em operating					

<b>FPT</b>			7				~
	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
113		Trend Review	zz_Control	Sequences		No anomalies noted.	Didn't Test
CA	Test Descri	iption		-			
CA	Review tren	nd graphs for anomalies.					
118		Training Sign Off	zz_Control	Sequences		Training Conducted.	Didn't Test
CA	Test Descri	iption		-		Attendees were as required.  Documentation of the course provided.	
0/1		nat the training on all equiple, was attended by red					
120		z_Loop Response / Sequence	zz_Control	Sequences		Control loops responded acceptably. Action correct for application and normal positions of controlled devices.	Didn't Test
	Test Descri	iption		-			
CA	Verified all	sequences work:					
	Inverse Boiler BACN Boiler/ CO Me	e: Boilers B-1,2,3, Pump e rest schedule HW Loop shall enable Contr let MC/TP (Pump selected, alternat onitoring t each boiler room exit	roller when in Heat		proved by DP with al	arm	

## **Hot Water System**

FPT	Date	<b>Type of Test</b>	Function	Component	Device	Expected/Final Results	Status				
101	Test Desc	Configuration Check	zz_Control	Sequences		Installation is per the contract documents.	Didn't Test				
CA	Checked the configuration. Reviewed it against the contract documents and ensured its compliance.										
102	Test Desc	Document Review	zz_Control	Sequences		1. Approved Submittals/Shop Dwgs: Yes 2. Operations and Maintenance Data: Yes	Didn't Test				
CA	Ensured a electronic the contra	he required documents ha ill data for all components reports/test results includ- act documents and include s, bookmarks, table of con	involved with test e accurate compon a method to direct	are included. Verified ent designations that n ly navigate to specific	I that linked natch those used on	3. Completed Start Up Checklists and Tests: Yes 4. Warranty Information: Yes					
103		Prerequisite - Hydronic	zz_Control	Sequences		All systems ready; including: Electrical Distribution, Related Piping Systems including, Water TAB, Control Systems. All	Didn't Test				
CA		that all supporting and/or for FPTs on this system.	related systems ha	- ve been started and tes	sted to the extent	labeling affixed and adequate access is provided to all components.					
104	Test Desc	Start Up Review	zz_Control	Sequences		Start up was adequate.	Didn't Test				
CA	Reviewed	I the start up documentation	on and the prefunct	ional checklists.							
105	Test Desc	Graphic - Setup	zz_Control	Sequences		BAS graphic was acceptable. All points were validated.	Didn't Test				
CA	Reviewed	I graphic for accuracy, quant. For inputs manipulate om graphic and obsesrve a	sensor to vaildate	graphic update. For ou	oints for proper atputs, command						
106	Test Desc	Graphic - Setpoints	zz_Control	Sequences -		All setpoints are adjustable (none in code).	Didn't Test				
CA	Validated that the setpoints required to be adjustable per the sequence can be changed directly from the graphic and/or a function block menu.										

FPT										
	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status			
107		Equip - S/S Feedback	zz_Control	Sequences		'Stop' and 'Start' states displayed on workstation matched command and actual status.	Didn't Test			
CA	Test Descri		Observa actual and	dieplayed status at OI						
	Send 'Stop' and 'Start' Commands. Observe actual and displayed status at OI.									
108		Equip Interlock	zz_Control	Sequences		Equipment interlock in place to prevent operation of equipment, and/or verify all applicable	Didn't Test			
CA	Test Descri	_		-		equipment is interlocked and running.				
	equipment i	gramming and configure is not operationaly or in ipment operation.								
109		Equip - Power Interrupt	zz_Control	Sequences		A. All devices go to their fail position. Unit stops. [Panel clock keeps correct time/date.] [Interlocked equipment responds per specification].	Didn't Test			
CA	Test Descri	•		-		B. Unit restarts and enters correct operational mode.				
0/1	A. Interrupted power to the unit [system] by [opening the disconnect.] [tripping the breaker.]									
	B. Restored	power to the unit by [cl	osing the disconne	ct.] [resetting the break	ker.]					
110		Equip - Alarm	zz_Control	Sequences		Alarm enunciated locally at the control panel, and at the BAS Operator Interface.	Didn't Test			
CA	Test Descri	-		-						
		oment/unit to go into ala oper enunciation in the o		concert with other fai	ilure tests. This test					
111		Safety Seqs	zz_Control	Sequences		All devices set and tripped appropriately.	Didn't Test			
CA	Test Descri	•		-						
0,1	Verified all	relevant safeties are fun	ctioning properly							
112		Steady-State Operation	zz_Control	Sequences		All control loops and functions operating normally per spec. Date/Time:	Didn't Test			
CA	Test Descri	ption		-						
OA .	Observe sys parameters.	tem in operation before	making any change	es. Recorded key syste	em operating					

FPT	Date	Type of Test	Function	Component	Device	Expected/Final Results	Status
113 CA	Test Desc	Trend Review ription end graphs for anomalies.	zz_Control	Sequences -		No anomalies noted.	Didn't Test
118 CA		Training Sign Off ription that the training on all eq table, was attended by rec				Training Conducted. Attendees were as required. Documentation of the course provided.	Didn't Test
120 CA	A. Genera B. Pump ( C. Boiler) D. Boiler) E. Alterna F. Lead Bo G. HW Ro H. Paralle I Boiler H J. Alarms	Il sequences work:  I Control Startup Shutdown ting Boiler Assignment oiler esset Iling Boilers W Temp Alarms  DC point configuration	zz_Control	Sequences -		Control loops responded acceptably. Action correct for application and normal positions of controlled devices.	Didn't Test

# DIVISION 2 EXISTING CONDITIONS

#### SECTION 024119 - SELECTIVE DEMOLITION

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General Notes apply to and form a part of the Specifications.

## 1.2 SUMMARY

#### A. Section Includes:

- 1. Demolition and removal of selected equipment, components, and accessories.
- 2. Salvage of existing items to be reused or recycled.

## 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

# 1.4 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.

#### 1.5 PRE-INSTALLATION MEETINGS

- A. Pre-demolition Conference: Conduct conference at Project site:
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and requires protection.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Pre-demolition Photographs or Video: Submit before Work begins:
  - 1. Shall include all areas of the Work including staging area, material storage areas and site improvements that could be damaged by construction activities. Site improvements include paved surfaces, landscaping, grassed surfaces, etc.
  - 2. Include those areas used by contractor to access the work, such as stairs, corridors, doors, etc.
  - 3. All damage to existing building, paving, landscaping or any other surface shall be repaired to original or better condition, as determined by Engineer.
- E. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
- B. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

#### 1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building and the potential exists for the Owner to occupy areas immediately adjacent to selective demolition areas. 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. The Owner intends to only move what's required for Contractor to perform their work and will have furniture and loose equipment moved to one side or both sides of where Contractor will be performing the Work. Contractor shall perform work carefully to not damage furniture and loose equipment and help keep it protected with coverings as necessary.
  - 1. Before selective demolition, Owner will remove the following items:
    - a. Furniture.
    - b. Loose Equipment.
- C. Notify Engineer 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:
  - If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer 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.

## 1.9 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties. Notify warrantor before proceeding.

B. Notify warrantor on completion of selective demolition and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

#### PART 2 - PRODUCTS

## 2.1 PEFORMANCE 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 ANSI/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.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings:
  - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.
  - 2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

## 3.2 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 indicated utility services and mechanical/electrical systems serving areas to be selectively demolished:
  - 1. Contractor shall coordinate and arrange shut-off of indicated services/systems.
  - 2. Arrange to shut off indicated utilities with utility companies.
  - 3. 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.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, electrical and HVAC systems, equipment, and components indicated 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.
    - 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.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

## 3.3 PREPARATION

- A. 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:
  - 1. Comply with requirements for access and protection specified in Division 1 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain:
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 1 Section "Temporary Facilities and Controls."

- C. Temporary Shoring: 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:
  - 1. Strengthen or add new supports when required during progress of selective demolition.

## 3.4 SELECTIVE DEMOLITION, GENERAL

- 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. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. 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, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. 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.
  - 5. Maintain adequate ventilation when using cutting torches.
  - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

## B. Salvaged Items, General:

- 1. The Owner reserves the rights to all scrap materials and equipment that may have salvage value.
- 2. The Owner will direct the Contractor where storage of these materials will occur within, or near, the existing facilities.

## C. Removed and Salvaged Items:

- 1. Clean salvaged items.
- 2. Pack or crate items after cleaning. Identify contents of containers.
- 3. Store items in a secure area until delivery to Owner.
- 4. Transport items to Owner's storage area on-site.
- 5. Protect items from damage during transport and storage.

#### D. Removed and Reinstalled Items:

- 1. Clean and repair items to functional condition adequate for intended reuse.
- 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
- 3. Protect items from damage during transport and storage.
- 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, 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.

#### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill:
  - 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. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Burning of demolished materials will not be permitted.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

## 3.6 CLEANING

A. 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 033000 - CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:
  - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.

## 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

# 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special concrete finish Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer.
- B. Welding certificates.
- C. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Curing compounds.
  - 6. Floor and slab treatments.
  - 7. Bonding agents.
  - 8. Adhesives.
  - 9. Vapor retarders.

- 10. Semirigid joint filler.
- 11. Joint-filler strips.
- 12. Repair materials.
- D. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- E. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer, detailing fabrication, assembly, and support of formwork.
  - 1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.
- F. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- G. Field quality-control reports.
- H. Minutes of preinstallation conference.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

#### 1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

## 1.9 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

#### 1.10 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:
  - 1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

#### PART 2 - PRODUCTS

# 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301 (ACI 301M).
  - 2. ACI 117 (ACI 117M).

## 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
- 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.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  - Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn or galvanized, depending on location.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

- B. 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 precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainlesssteel bar supports.
  - 2. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

## 2.5 CONCRETE MATERIALS

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray.
  - 2. Fly Ash: ASTM C 618, Class F.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
  - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches (38 mm) nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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 Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- F. Water: ASTM C 94/C 94M and potable.

#### 2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick.

## 2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Euclid Chemical Company (The); Eucobar or approved equal.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
  - 1. Dayton Superior Clear Resin Cure J11W or approved equal.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
  - 1. Dayton Superior Cure & Seal 25% J22UV or approved equal.

#### 2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 according to ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

## 2.9 REPAIR MATERIALS

- A. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

## 2.10 CONCRETE MIXTURES, GENERAL

- 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 (ACI 301M).
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

## 2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

Footings: Normal-weight concrete as indicated on Structural Drawings.

B. Slabs-on-Grade: Normal-weight concrete as indicated on Structural Drawings.

#### 2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

#### 2.13 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 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## PART 3 - EXECUTION

## 3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, 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 (ACI 117M).
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
  - 2. Class B. 1/4 inch (6 mm) for rough-formed finished surfaces.

- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. 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. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

## 3.2 EMBEDDED ITEM INSTALLATION

- 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.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 2. 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.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

#### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
  - 1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  - 2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

## 3.4 SHORING AND RESHORING INSTALLATION

- A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.
  - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

#### 3.5 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

#### 3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- 1. Do not cut or puncture vapor retarder. 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.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

## 3.7 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. 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. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
  - 3. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. 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 one-fourth 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 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

## 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is 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. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and opentextured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

#### 3.9 FINISHING 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 not 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 to receive a rubbed finish.
- 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.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

## 3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill

low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

- 1. Apply float finish to surfaces to receive trowel finish.
- C. 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 that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view.
  - 2. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch (3.2 mm).
  - 3. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

## 3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

## 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/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. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), 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.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - 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.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

## 3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least [one] [six] month(s). Do not fill joints until construction traffic has permanently ceased.

- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

#### 3.14 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.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  - 2. After concrete has cured at least 14 days, correct high areas by grinding.
  - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

- 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
- 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
- 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

#### 3.15 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
  - 1. Steel reinforcement placement.
  - Headed bolts and studs.
  - 3. Verification of use of required design mixture.
  - 4. Concrete placement, including conveying and depositing.
  - 5. Curing procedures and maintenance of curing temperature.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

- 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
  - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
- 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
- 3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; Jone test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or 80 deg F (27 deg C) and above, and one test for each composite sample.
- 5. Unit Weight: ASTM C 567/C 567M, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
- 6. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure[two sets of two standard cylinder specimens for each composite sample.
- 7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
  - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
- 8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
- 9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).

- 10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- 11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- 12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
- 13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- 14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

## SECTION 044200 - EXTERIOR STONE CLADDING

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Cut oolitic limestone and dolomitic limestone veneer at exterior walls.
- B. Metal anchors and supports.
- C. Sealing exterior joints.

#### 1.2 RELATED REQUIREMENTS

- A. Section 054000 Cold-Formed Metal Framing: Steel framing members supporting stone.
- B. Section 076200 Sheet Metal Flashing and Trim: Flashings at copings, lintels, and sills
- C. Section 079200 Joint Sealants: Sealing perimeter and expansion joints in interior stone work.

## 1.3 REFERENCE STANDARDS

- A. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2016.
- B. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. ASTM C119 Standard Terminology Relating to Dimension Stone; 2020.
- D. ASTM C270 Standard Specification for Mortar for Unit Masonry; 2014a.
- E. ASTM C568/C568M Standard Specification for Limestone Dimension Stone; 2015.
- F. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014a.
- G. ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- H. ASTM C1330 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
- ASTM C1528/C1528M Standard Guide for Selection of Dimension Stone: 2018.

J. ILI (HB) - Indiana Limestone Handbook; 2007.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

## 1.5 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on stone, mortar products, and sealant products.
- C. Shop Drawings: Indicate layout, pertinent dimensions, anchorages, head, jamb, and sill opening details, and jointing methods.
- D. Samples: Submit two stone samples 12 by 12 inch in size, illustrating color range and texture, markings and surface finish
- E. Stone Fabricator's Qualification Statement.
- F. Installer's Qualification Statement.

## 1.6 QUALITY ASSURANCE

- A. Design anchors and supports under direct supervision of a Professional Structural Engineer, registered in the State in which the Project is located.
  - 1. Design anchors to resist positive and negative wind pressures and other loads as required by applicable code.
  - 2. Design anchor attachment to stone with a factor of safety of 5:1.
  - 3. Design each individual anchor with a factor of safety in the vertical dead-loadbearing direction of 4:1 and in the horizontal lateral-load-bearing direction of 2:1.
- B. Perform work in accordance with ILI Indiana Limestone Handbook.
- C. Maintain one copy of each document on site.
- D. Stone Fabricator: Company specializing in fabricating cut stone with minimum ten years of documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of experience.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store stone panels vertically on edge, resting weight on panel edge.
- B. Protect stone from discoloration.

## 1.8 FIELD CONDITIONS

A. During temporary storage on site, at the end of working day, and during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

#### PART 2 PRODUCTS

#### 2.1 STONE

- A. Stone, General: See recommendations in ASTM C1528/C1528M.
- B. Oolitic Limestone: To match existing; complying with ASTM C568/C568M Classification I Low Density.
  - 1. Grade: ILI Standard.
  - 2. Color: To match existing.
  - 3. Grain Direction: Horizontal.
  - 4. Surface Finish: Honed; as described in ASTM C119 and ASTM C1528/C1528M.
  - 5. Acceptable Producers:
    - a. Alabama Stone Co: www.alabamastone.com/#sle.
    - b. Indiana Limestone Company: www.indianalimestonecompany.com/#sle.
    - c. Stone Center; www.stonecenters.com.

#### 2.2 MORTAR

A. Mortar: ASTM C270, Type N, Proportion specification, using Portland cement of white color.

## 2.3 ANCHORS AND ACCESSORIES

- A. Anchors and Other Components in Contact with Stone: Stainless steel, ASTM A666, Type 304.
  - 1. Sizes and configurations: As required for vertical and horizontal support of stone and applicable loads.
  - 2. Wire ties are not permitted.
- B. Support Components not in Contact with Stone: Stainless steel, ASTM A240/A240M, Type 304.
- C. Setting Buttons and Shims: Lead type.
- D. Joint Sealant: ASTM C920 silicone sealant with movement capability of at least plus/minus 25 percent and non-staining to stone when tested in accordance with ASTM C1248.
- E. Joint Backer Rod: ASTM C1330 open cell polyurethane of size 40 to 50 percent larger in diameter than joint width.

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#### 2.4 STONE FABRICATION

- A. Thickness: 3/4 inch.
- B. Panel Size: To match existing.
- C. Fabricate units for uniform coloration between adjacent units and over the full area of the installation.

#### PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Verify that support work and site conditions are ready to receive work of this section.
- B. Verify that items built-in under other sections are properly located and sized.

## 3.2 PREPARATION

A. Clean stone prior to erection. Do not use wire brushes or implements that will mark or damage exposed surfaces.

#### 3.3 INSTALLATION

- A. Set stone with a consistent joint width of 3/8 inch.
- B. Install anchors and place setting buttons to support stone and to establish joint dimensions.
- C. Joints in Exterior Work: Seal joints with joint sealant over backer rod, following sealant manufacturer's instructions; tool sealant surface to concave profile.
- D. Joints in Interior Work: Leave perimeter joints and expansion joints open for sealant; fill other joints with pointing mortar; pack and work into voids; tool surface to concave joint.

## 3.4 TOLERANCES

- A. Positioning of Elements: Maximum 1/4 inch from true position.
- B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet; 1/2 inch in 50 feet.
- C. Maximum Variation Between Face Plane of Adjacent Panels: 1/16 inch.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in any two stories.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch maximum.

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F. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

# 3.5 CUTTING AND FITTING

- A. Obtain approval prior to cutting or fitting any item not so indicated on drawings.
- B. Do not impair appearance or strength of stone work by cutting.

## 3.6 CLEANING

- A. Remove excess joint material upon completion of work.
- B. Clean soiled surfaces with cleaning solution.
- C. Use non-metallic tools in cleaning operations.

## **END OF SECTION**

# DIVISION 5 METALS

#### SECTION 051200 - STRUCTURAL STEEL FRAMING

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Structural steel.
  - 2. Grout.

## B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for steel lintels not attached to structuralsteel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
- 2. Section 055000 "Metal Fabrications" for anchor bolts and other post-installed anchors.

## 1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

## 1.4 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

## 1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

## 1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Welding certificates, if requested.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats, if requested.
- C. Mill test reports for structural steel, including chemical and physical properties, if requested.
- D. Product Test Reports: For the following, if requested:
  - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 2. Direct-tension indicators.
  - 3. Shear stud connectors (welded stud anchors).
  - 4. Shop primers.
  - 5. Nonshrink grout.

# 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that is a member of American Institute of Steel Construction.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 341 and AISC 341s1.
  - 3. AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

# 1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

- 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

# PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. Connection Design Information:
  - 1. Option 2: Fabricator's experienced steel detailer shall select or complete connections in accordance with ANSI/AISC 303.
    - a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
    - b. Use Allowable Stress Design; the following data are given at service-load level.
      - 1) Unless otherwise indicated on the Drawings, connections are to be designed using 75% of the maximum member end reaction.

# 2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles-Shapes: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
  - 1. Weight Class: As indicated.
  - 2. Finish: Black.
- F. Welding Electrodes: Comply with AWS requirements.

# 2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

- 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. Shear Stud Connectors (welded stud anchors): ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.
- C. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 2. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - Finish: Plain.
- D. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- E. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

## 2.4 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: ASTM A 780/A 780M.

## 2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

# 2.6 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
  - 1. Fabricate beams with rolling camber up.
  - 2. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear stud connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

# 2.7 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless indicated to be Pretensioned or Slip critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.8 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces to be field welded.
  - 2. Surfaces of high-strength bolted, slip-critical connections.
  - 3. Galvanized surfaces.
- B. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

# 2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

- 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
- 2. Galvanize steel where indicated on the drawings.

## PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor bolts, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor bolts, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Anchor bolts for base plates are to be post-installed drilled in type. Refer to Section 055000 "Metal Fabrications" for anchor bolts and other post-installed anchors.
- C. Base Plates and Bearing Plates indicated to receive grout: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Snug-tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 3. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

- E. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- F. Splice members only where indicated.
- G. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- I. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

# 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened, unless indicated to be Slip Critical.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
  - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

## 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
  - In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.
- E. In addition to visual inspection, test and inspect field-welded shear stud connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
  - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.

# 3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

**END OF SECTION 051200** 

## SECTION 053100 - STEEL DECKING

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. Section Includes:
  - Roof deck.
- B. Related Requirements:
  - 1. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

# 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings:
  - Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of steel deck.
- B. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
  - 1. Power-actuated mechanical fasteners.
- C. Evaluation Reports: For steel deck, from ICC-ES, if requested.

## 1.5 QUALITY ASSURANCE

A. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

# 2.2 ROOF DECK

- A. <u>Basis-of-Design Product</u>: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Epic Metals Corporation.
  - 2. New Millennium Building Systems, LLC.
  - 3. Nucor Corp.; Vulcraft Group.
  - 4. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
  - 1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating.
  - 2. Deck Profile: As indicated.
  - 3. Profile Depth: As indicated.
  - 4. Design Uncoated-Steel Thickness: As indicated.
  - 5. Span Condition: Double span minimum.
  - 6. Side Laps: Overlapped.

## 2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter or equivalent proprietary sidelap screws.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- F. Galvanizing Repair Paint: ASTM A 780/A 780M.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine supporting frame and field 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, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

## 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by mechanical fasteners arranged in the respective pattern indicated on the drawings.
  - 1. Mechanically fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws or power actuated fasteners of equivalent strength.
- A. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated on the drawings and as follows:
  - 1. Except where otherwise noted, mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
- B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. Roof Deck End Joints: Lapped 2 inches minimum.
- B. Miscellaneous Roof-Deck Accessories: Install ridge plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

# 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Deck fasteners will be subject to inspection.

#### 3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

**END OF SECTION 053100** 

# SECTION 054000 - COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

## 1.2 REFERENCE STANDARDS

- A. AISI S100 North American Specification for the Design of Cold-Formed Steel Structural Members; 2016.
- B. AISI S100-12 North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.
- C. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- D. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- E. ASTM C955 Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2015.
- F. ASTM C1007 Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a (Reapproved 2015).
- G. AWS D1.1/D1.1M Structural Welding Code Steel; 2015 (with March 2016 Errata).
- H. AWS D1.3/D1.3M Structural Welding Code Sheet Steel; 2008.
- I. PS 1 Structural Plywood; 2009.
- J. SSPC-Paint 20 Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004),

# 1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

## 1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

## PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Metal Framing:
  - 1. ClarkDietrich Building Systems: www.clarkdietrich.com.
  - 2. Marino: www.marinoware.com.
  - 3. The Steel Network, Inc: www.SteelNetwork.com.
- B. Framing Connectors and Accessories:
  - 1. Same manufacturer as metal framing.

# 2.2 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Design Requirements: Provide completed framing system having the following characteristics:
  - 1. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
  - Design Loads: In accordance with applicable codes.
  - 3. Live load deflection meeting the following, unless otherwise indicated:
    - a. Exterior Walls: Maximum horizontal deflection under wind load of 1/360 of span.
    - b. Design non-axial loadbearing framing to accommodate not less than

## 1/2 in vertical deflection.

- 4. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
- 5. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- C. Shop fabricate framing system to the greatest extent possible.
- D. Deliver to project site in largest practical sections.

## 2.3 FRAMING MATERIALS

- A. Studs and Track: ASTM C955; studs formed to channel, C- or Sigma-shaped with punched web; U-shaped track in matching nominal width and compatible height.
  - 1. Gage as required and Depth as indicated on architectural drawings: As required to meet specified performance levels.
  - 2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.
  - Products:
    - a. CEMCO; ProX Header: www.cemcosteel.com/#sle.
    - b. MBA Building Supplies; Structural Studs & Track: www.mbastuds.com/#sle.
    - c. Super Stud Building Products, Inc; SuperMAXX Studs: www.buysuperstud.com/#sle.
    - d. Substitutions: See Section 016000 Product Requirements.
- B. Jamb Studs: Engineered, C-shaped with wide flanges, designed to replace conventional double-stud framing at openings.
  - 1. Products:
    - a. SCAFCO Corporation; Kwik-Jamb Studs: www.scafco.com/#sle. b. Substitutions: See Section 016000 Product Requirements.
- C. Header: Engineered one-member or two-member assembly, with wide flanges, designed to replace conventional box or nested header framing at openings.
  - 1. Jamb Mounting Clips: Manufacturer's standard.
- D. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.
  - 1. Base Metal: Structural Steel (SS), Grade 50/340, Class 1.
  - 2. Gauge and Depth: As required to meet specified performance levels.
- E. Framing Connectors: Factory-made, formed steel sheet.
- 1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with

- G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gauge, 0.1345 inch, and factory punched holes and slots.
- 2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100.
- Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and stepped bushings, while maintaining structural performance of framing. Provide movement connections at all locations where study attach to structure above.
  - a. Where continuous studs bypass elevated floor slab or roof, connect stud to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
  - b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
- 4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
- Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections as required by vendors engineer.

# 2.4 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
- B. Anchorage Devices: Powder actuated.
- C. Welding: Comply with AWS D1.1/D1.1M.

### 2.5 WALL SHEATHING

A. Plywood; PS 1, Grade C-D, Exposure I.

## 2.6 ACCESSORIES

- A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I Inorganic, complying with VOC limitations of authorities having jurisdiction.

## 2.7 FASTENERS

- A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.
  - 1. Products:
    - a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.
- B. Anchorage Devices: Powder actuated.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify field measurements and adjust installation as required.

#### 3.2 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.
- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using clip and tie method.
- D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.
- E. Install load-bearing studs full length in one piece. Splicing of studs is not permitt
- F. Install load-bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- G. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- J. Attach cross studs to studs for attachment of fixtures anchored to walls.
- K. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

L. Touch-up field welds and damaged galvanized surfaces with primer.

# 3.3 INSTALLATION OF JOISTS AND PURLINS

- A. Install framing components in accordance with manufacturer's instructions.
- B. Make provisions for erection stresses. Provide temporary alignment and bracing.

# 3.4 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

**END OF SECTION** 

#### SECTION 055000 - METAL FABRICATIONS

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

## A. Section Includes:

- 1. Steel framing and supports for mechanical and electrical equipment.
- 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- 3. Metal ladders.
- 4. Metal floor plate and supports.
- 5. Metal bollards.
- 6. Loose bearing plates for applications where they are not specified in other Sections.
- 7. Post-installed Drilled in Anchors in masonry and concrete.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
  - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

# C. Related Requirements:

- 1. Section 033000 "Cast-in-Place Concrete" for installing steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
- 2. Section 042000 "Unit Masonry" for installing loose lintels and other items built into unit masonry.
- 3. Section 051200 "Structural Steel Framing."

# 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
  - 3. Drilled in anchors in masonry and concrete.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for mechanical and electrical equipment.
  - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 3. Metal ladders.
  - Metal bollards.
  - 5. Loose steel lintels.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements, if requested.
- B. Welding certificates, if requested.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats, if requested.
- D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.
- E. Drilled in anchors in masonry and concrete data: Certified test reports showing compliance with specified performance characteristics and physical properties, ICC ES Evaluation Reports and manufacturer's installation instructions.

# 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel."
- C. Qualifications for Drilled in anchor installation: As follows.
  - 1. Installer Qualifications: Drilled-in anchors shall be installed by a contractor with at least three years of experience performing similar installations.
  - 2. Installer Training: Conduct a thorough training with the manufacturer or the manufacturer's representative for the Contractor on the project. Training to consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

- a. Hole drilling procedure.
- b. Hole preparation & cleaning technique.
- c. Adhesive injection technique & dispenser training / maintenance.
- d. Rebar dowel preparation and installation.
- e. Proof loading/torqueing.
- 3. Certifications: Unless otherwise authorized by the Engineer, anchors shall have an ICC ES Evaluation Report indicating conformance with current applicable ICC ES Acceptance Criteria.

## 1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

# PART 2 - PRODUCTS

#### 2.1 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel W Shapes: ASTM A992/A 992M.
- C. Steel Plates, Other Shapes, and Bars: ASTM A 36/A 36M.
- A. Low-Alloy-Steel Reinforcing Bars: Compliant with ASTM A 706/A 706M, deformed for welded ladder rungs.
- B. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

## 2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.

- D. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
- F. Welded Stud Anchors (Shear Connectors): ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.
- G. Drilled-in Anchors: Provide the following as indicated on the Drawings.
  - Wedge Anchors: Wedge type, torque-controlled, with impact section to prevent thread damage complete with required nuts and washers. Provide anchors with length identification markings conforming to ICC ES AC01 or ICC ES AC193. Type and size as indicated on Drawings.
    - a. Interior Use: Provide carbon steel anchors with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
    - b. Exterior Use: Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. Stainless steel nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
    - c. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Hilti Kwik Bolt 3, ICC ESR-1385 and ESR-2302.
      - 2) Hilti Kwik Bolt TZ, ICC ESR-1917 (carbon steel and AISI Type 304 Stainless Steel).
  - 2. Screw Anchors: screw type. Pre-drilling of the hole requires a standard ANSI drill bit with the same diameter as the anchor and installing the anchor will be done with an impact wrench. Provide anchors with a diameter and anchor length marking on the head. Type and size as indicated on Drawings.
    - a. Interior Use: Unless otherwise indicated on the Drawings, provide carbon steel anchors with zinc plating equivalent to DIN EN ISO 4042 (8µm min.).
    - b. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Hilti Kwik-HUS-EZ, ICC-ESR 3027.
      - 2) Hilti Kwik-HUS EZ-I, ICC-ESR 3027.
      - 3) Hilti Kwik-HUS.

- Cartridge Injection Adhesive Anchors: Threaded steel rod, inserts or reinforcing dowels, complete with nuts, washers, polymer or hybrid mortar adhesive injection system, and manufacturer's installation instructions. Type and size as indicated on Drawings.
  - a. Interior Use and Structural Steel Column Base Plates: Provide carbon steel threaded rods conforming to ASTM A36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
    - 1) Provide diameter and embedment indicated on the Drawings.
  - b. Exterior Use: Provide stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.
  - c. Reinforcing dowels shall be A615 Grade 60
  - d. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - Threaded steel rods and reinforcing dowels with Euclid Dural Fast Set Gel
    - 2) Hilti HAS threaded rods with HIT-HY 200 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchor and rebar anchorage to concrete, ICC ESR-3187.
    - 3) Hilti HIT-Z anchor rods with HIT-HY 200 Safe Set System for anchorage to concrete, ICC ESR-3187.
    - 4) Hilti HAS threaded rods with HIT-RE 500 V3 Safe Set System using Hilti Hollow Drill Bit and VC 150/300 vacuum System for anchor and rebar anchorage to concrete, ICC ESR-3814.
- 4. Capsule Anchors: Threaded steel rod and reinforcing dowels with 45 degree chisel point, complete with nuts, washers, glass or foil capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, and manufacturer's installation instructions. Type and size as indicated on Drawings.
  - a. Interior Use: Provide chisel-pointed carbon steel rods conforming to ASTM A36, ASTM A 193 Type B7 or ISO 898 Class 5.8 with zinc plating in accordance with ASTM B633, Type III Fe/Zn 5 (SC1).
  - b. Exterior Use: Provide chisel-pointed stainless steel anchors. Stainless steel anchors shall be AISI Type 304 stainless steel provided with stainless steel nuts and washers of matching alloy group and minimum proof stress equal to or greater than the specified minimum full-size tensile strength of the externally threaded fastener. All nuts shall conform to ASTM F594 unless otherwise specified. Avoid installing stainless steel anchors in contact with galvanically dissimilar metals.

- c. Reinforcing dowels shall be A615 Grade 60, with 45-degree chisel-points at embedded end.
- d. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - 1) Hilti HVA Adhesive System with HVU capsules.

## 2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- D. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight concrete.

# 2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

# 2.5 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
  - 1. Fabricate units from slotted channel framing where indicated for support of piping, conduit, and mechanical equipment.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Prime miscellaneous framing and supports except where indicated to be galvanized.

# 2.6 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
  - 1. Space siderails 18 inches apart unless otherwise indicated.
  - 2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
  - 1. Rungs: 3/4-inch-diameter steel rods.
  - 2. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 3. Support each ladder at top and bottom and not more than 60 inches o.c. with welded steel brackets.
  - 4. Prime interior ladders, including brackets and fasteners.

## 2.7 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe of diameter indicated on the Drawings.
- B. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.
- C. Shop weld 3/16-inch thick cap plates to removable bollards.
- D. Galvanize bollards.

## 2.8 LOOSE BEARING PLATES

- A. Provide loose bearing plates for steel items bearing on masonry or concrete construction.
- B. Provide welded stud anchors as indicated on the Drawings but provide a minimum of two welded stud anchors per plate. Welded stud anchors are to be ½ inch diameter for 4 inch embedment in concrete unless otherwise indicated on the Drawings.
- C. Furnish plates uncoated.

# 2.9 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length not less than 8 inches unless otherwise indicated.
- C. Lintels not otherwise indicated on the drawings are to be furnished as one angle for each nominal 4" of wall thickness as follows:
  - Spans up to 1'-4"
     Spans 1'-5" TO 3'-0"
     Spans 3'-1" TO 4'-0"
     Spans 4'-1" TO 5'-0"
     Spans 4'-1" TO 5'-0"

    NO LINTEL REQUIRED
    L3 1/2 X 3 1/2 X 5/16
    L4 X 3 1/2 X 5/16 (LLV)
    L5 X 3 1/2 X 5/16 (LLV)
  - 5. Spans 5'-1" TO 6'-4" L6 X 3 1/2 X 3/8 (LLV)
- D. Provide plates for support of masonry as indicated.
- E. Galvanize and prime loose steel lintels in the exterior masonry wythe of exterior walls.
- F. Prime loose steel lintels in interior masonry walls.

## 2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete or masonry construction as needed to complete the Work. Provide each unit with no fewer than two ½ inch diameter by 4 inch long welded stud anchors for embedding in concrete.

# 2.11 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

#### 2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless otherwise indicated.
  - 1. Shop prime with universal shop primer.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

# 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

## 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

# 3.3 INSTALLING METAL BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

- C. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.
- D. Fill bollards solidly with concrete, mounding top surface to shed water.
  - 1. Do not fill removable bollards with concrete.

#### 3.4 INSTALLING BEARING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials. Clean bottom surface of plates.
- B. Embed welded stud anchors in Portland cement grout and set bearing plates on wedges or shims to proper elevation. After bearing members have been positioned and plumbed, do not remove wedges or shims. If bearing is to remain exposed to view, conceal wedges and shims. Pack non-shrink grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3.5 INSTALLING DRILLED-IN ANCHORS

- A. Drill holes with rotary impact hammer drills using carbide-tipped bits, or hollow drill bit system. Drill bits shall be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the Drawings, all holes shall be drilled perpendicular to the concrete surface.
  - Embedded Items: Identify position of reinforcing steel and other embedded items
    prior to drilling holes for anchors. Exercise care in coring or drilling to avoid
    damaging existing reinforcing or embedded items. Notify the Architect if
    reinforcing steel or other embedded items are encountered during drilling. Take
    precautions as necessary to avoid damaging prestressing tendons, electrical and
    telecommunications conduit, and gas lines.
  - 2. Base Material Strength: Unless otherwise specified, do not drill holes in concrete or masonry until concrete, mortar, or grout has reached 7 days strength.
  - 3. Perform anchor installation in accordance with manufacturer instructions.
  - 4. Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10% of the specified torque, 100% of the specified torque shall be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor shall be removed and replaced unless otherwise directed by the Engineer.

- 5. Cartridge Injection Adhesive Anchors: Clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive shall be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- 6. Capsule Anchors: Perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors shall be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed.
- 7. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.
- B. Repair of Defective Anchors: Remove and replace misplaced or malfunctioning anchors. Fill empty anchor holes and patch failed anchor locations with high-strength non-shrink, nonmetallic grout. Anchors that fail to meet proof load or installation torque requirements shall be regarded as malfunctioning.
- C. Field Quality Control and Testing: 10% of each type and size of drilled-in anchor may be proof loaded by the Owner's Testing Agency. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If more than 10% of the tested anchors fail to achieve the specified torque or proof load within the manufacturer specified limits, all anchors of the same diameter and type as the failed anchor shall be tested, unless otherwise instructed by the Engineer.
  - 1. Tension testing shall be performed in accordance with ASTM E488.
  - 2. Torque shall be applied with a calibrated torque wrench.
  - 3. Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.
  - 4. Minimum anchor embedments are indicated on the Drawings.

## 3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

# **DIVISION 6**WOOD, PLASTICS, AND COMPOSITES

#### SECTION 061000 - ROUGH CARPENTRY

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Rough opening framing for doors, windows, and roof openings.
- B. Roof-mounted curbs.
- C. Roofing nailers.
- D. Preservative treated wood materials.
- E. Fire retardant treated wood materials.
- F. Miscellaneous framing.
- G. Communications and electrical room mounting boards.
- I. Miscellaneous wood nailers, furring, and grounds.

# 1.2 REFERENCE STANDARDS

- A. ANSI A208.1 American National Standard for Particleboard; 2009.
- B. ASTM A153/A153M Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM C557 Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
- D. ASTM C1396/C1396M Standard Specification for Gypsum Board; 2017.
- E. ASTM D3498 Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2018a.
- F. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.
- G. ASTM E96/E96M Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- H. AWPA U1 Use Category System: User Specification for Treated Wood; 2017.
- I. ICC (IBC) International Building Code; 2015.
- J. PS 1 Structural Plywood; 2009.

SECTION 061000 – ROUGH CARPENTRY WYK Associates, Inc. K. PS 20 - American Softwood Lumber Standard; 2015.

## 1.3 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

# 1.4 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

## 1.5 WARRANTY

A. See Section 017700 - Closeout Procedures, for additional warranty requirements.

# PART 2 PRODUCTS

# 2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
  - Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

# 2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.

- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

#### 2.3 ACCESSORIES

- A. Fasteners and Anchors:
  - Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
  - 2. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.
  - 1. Manufacturers:
    - a. Franklin International, Inc; Titebond Fast Set Polyurethane Construction Adhesive: www.titebond.com/#sle.
    - b. Substitutions: See Section 016000 Product Requirements.

## 2.4 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
  - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
  - Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.
- B. Fire Retardant Treatment:
  - 1. Manufacturers:
    - a. Lonza Group: www.wolmanizedwood.com/#sle.
    - b. Hoover Treated Wood Products, Inc: www.frtw.com/#sle.
    - c. Koppers, Inc: www.koppersperformancechemicals.com/#sle.
    - d. Viance, LLC: www.treatedwood.com/#sle.
  - 2. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
    - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    - b. Treat rough carpentry items as indicated.
    - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

# C. Preservative Treatment:

- Manufacturers:
  - a. Lonza Group: www.wolmanizedwood.com/#sle.
  - b. Koppers Performance Chemicals, Inc: www.koppersperformancechemicals.com/#sle.
  - c. Viance, LLC: www.treatedwood.com/#sle.
  - d. Substitutions: See Section 016000 Product Requirements.
- 2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
  - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
  - b. Treat lumber in contact with roofing, flashing, or waterproofing.
  - c. Treat lumber in contact with masonry or concrete.

## PART 3 EXECUTION

# 3.1 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

# 3.2 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

# 3.3 ROOF-RELATED CARPENTRY

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where specifically indicated otherwise or where prefabricated roof cubs is specified in mechanical drawings and specifications. Form corners by alternating lapping side members.

# 3.4 TOLERANCES

- A. Framing Members: 1/4 inch from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

# 3.5 CLEANING

- A. Waste Disposal:
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.
  - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 061000

#### SECTION 071113 - BITUMINOUS DAMPPROOFING

#### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Bituminous dampproofing.
- B. Protection boards.
- C. Drainage panels.

# 1.2 REFERENCE STANDARDS

- A. ASTM D41/D41M Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2016).
- B. ASTM D1187/D1187M Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).
- C. ASTM D1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
- D. ASTM D3747 Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation; 1979 (Reapproved 2007).
- E. NRCA (WM) The NRCA Waterproofing Manual; 2005.

# 1.3 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide properties of primer, bitumen, and mastics.
- C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

# PART 2 PRODUCTS

# 2.1 MANUFACTURERS

- A. Basis of Design: BASF; MasterSeal 610, 614, 615.
- B. Other Acceptable Bituminous Dampproofing Manufacturers:
  - 1. W. R. Meadows, Inc; Sealmastic: www.wrmeadows.com/#sle.
  - 2. Substitutions: See Section 016000 Product Requirements.

#### 2.2 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
  - Composition Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
  - 2. Composition Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
  - 3. VOC Content: Not more than permitted by local, State, and federal regulations.
  - 4. Applied Thickness: 1/16 inch, minimum, wet film.
  - 5. Products:
    - a. W. R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com/#sle.
    - b. BASF: MasterSeal 610.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

#### 2.3 **BITUMEN MATERIALS**

- Cold Asphaltic Type: Α.
  - 1. Bitumen: Asphalt emulsion, ASTM D3747.
  - Asphalt Primer: ASTM D41/D41M, compatible with substrate.

#### 2.4 **ACCESSORIES**

A. Drainage Panel/Protection Board: 1/4 inch thick formed plastic, hollowed sandwich.

# PART 3 EXECUTION

#### 3.1 **EXAMINATION**

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

#### 3.2 **PREPARATION**

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

SECTION 071113 - BITUMINOUS **DAMPPROOFING** 

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D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

### 3.3 APPLICATION

- A. Foundation Walls: Apply two coats of asphalt dampproofing.
- B. Foundation Walls: Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.
- C. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- D. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- E. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.
- F. Apply bitumen with roller.
- G. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F; do not exceed finish blowing temperature for four hours.
- H. Apply from 2 inches below finish grade elevation down to top of footings.
- I. Seal items watertight with mastic, that project through dampproofing surface.
- J. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downward.
- K. Place protection board over drainage panel, butt joints, and adhere with mastic.
- L. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION 071113

# SECTION 072100 - THERMAL INSULATION

# PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

A. Board insulation at perimeter foundation wall and underside of floor slabs.

# 1.2 REFERENCE STANDARDS

- A. ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2017a.
- B. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials; 2017.

# 1.3 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

# 1.4 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Thermal Insulation Manufacturers:
  - 1. Owens Corning Corporation.
  - 2. Dow Chemical Company.
  - 3. Kingspan Insulation LLC
  - 4. Substitutions: See Section 016000 Product Requirements.

# 2.2 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board. 3 in. Thick.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board. 3 in. Thick.

#### 2.3 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
  - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
  - 2. Flame Spread Index (FSI): Class A 0 to 25, when tested in accordance with ASTM E84.
  - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
  - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.
  - 5. Board Edges: Square.
  - 6. Thickness: 3 in.
  - 7. Type and Water Absorption: Type IV, 0.3 percent by volume, maximum, by total immersion.
  - 8. Manufacturers:
    - a. Dow Chemical Company: www.dowbuildingsolutions.com/#sle.
    - b. Kingspan Insulation LLC: www.kingspan.com/#sle.
    - c. Owens Corning Corporation: www.ocbuildingspec.com/#sle.
    - d. Substitutions: See Section 016000 Product Requirements.

# 2.4 ACCESSORIES

- A. Tape joints of rigid insulation in accordance with insulation manufacturers' instructions.
- B. Adhesive: Type recommended by insulation manufacturer for application and compatible with Fluid Applied Air Barrier and Sheathing.

# PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

# 3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Apply adhesive to back of boards:
  - 1. Three continuous beads per board length.
- B. Install boards horizontally & vertically on foundation perimeter.
  - 1. Place boards to maximize adhesive contact.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

# 3.3 BOARD INSTALLATION UNDER CONCRETE SLABS

- A. Place insulation under slabs on grade after base for slab has been compacted.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- C. Prevent insulation from being displaced or damaged while placing vapor/gas barrier slab.

# 3.4 FIELD QUALITY CONTROL

- A. See Section 014000 Quality Requirements, for additional requirements.
- B. Do not cover air barrier work until tested, inspected, and accepted.

### 3.5 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

# END OF SECTION 072100

#### SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

#### PART 1 GENERAL

# 1.1 SECTION INCLUDES

1.2 Materials and installation for Fluid-Applied Membrane to provide an Air Barrier Component and secondary Waterproof Barrier/Drainage plane for Unit Masonry Wall Assemblies.

#### 1.3 RELATED SECTIONS

- A. Section 042000 Unit Masonry
- B. Section 076200: Sheet Metal Flashing and Trim
- C. Section 079200: Joint Sealants

# 1.4 REFERENCED DOCUMENTS

- A. ASTM Standards
  - 1. D 522 Test Methods for Mandrel Bend Test of Attached Organic Coatings.
  - 2. D 2247 Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
  - 3. E 84 Test Method for Surface Burning Characteristics of Building Materials.
  - 4. E 96 Test Methods for Water Vapor Transmission of Materials.
- B. Building Code Standards
- C. SBCCI PST & ESI Evaluation Guide on Floor, Wall, and Roof Systems (Testing for Moisture Protection Barriers), Evaluation Guide 119.
- D. UBC 26-9, Method of Test for the Evaluation of Flammability Characteristics of Exterior, Nonload-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
- E. ICBO Acceptance Criteria for Exterior Insulation and Finish Systems, AC 24.
- F. CCMC Technical Guide on Air Barriers.
- 1.5 AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)
  - A. 1. 2001 ASHRAE Handbook-Fundamentals.

#### 1.6 DESIGN REQUIREMENTS

- A. Deflection Criteria: maximum allowable deflection normal to the plane of the wall: L/240.
- B. Wind Load: conform with code requirements.
- D. Minimize condensation within the assembly.
- E. Drain water directly to the exterior where it is likely to penetrate components in the wall assembly (windows and doors, for example).
- F. Provide flashing to direct water to accordance with code
- G. requirements, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, intersections of lower walls with higher walls, and at the base of the wall.
- H. Air Barrier Continuity: provide continuous air barrier system of compatible air barrier components.
- I. Mechanical Ventilation: maintain pressurization and indoor humidity levels in accordance with recommendations of ASHRAE (see 2001 ASHRAE Handbook-Fundamentals).
  - 1. PERFORMANCE REQUIREMENTS

# 1.7 PROSOCO R-GUARD™ WATERPROOFING/AIR BARRIER PERFORMANCE DATA

Test	Method	Criteria	Results
Aging Water Penetration Resistance	AATCC127 (Water Column)	Resist 21.6 in (55 cm) water for 5 hours before and after aging.	No water penetration before and after aging. No water penetration at 332 inches (843cm) head of water before aging.
Structural Loading Water Penetration Testing	ASTM E 1233 ASTM E 331	No water at exterior plane of sheathing (exterior gypsum, Dens-Glass Gold, plywood, OSB) after 10 cycles at 80% design load and 75 minutes water spray at 6.24 psf (299 Pa) pressure differential with water spray rate of 5 gal/ft <sup>2</sup> -hr (3.4 L/m <sup>2</sup> -min).	No water penetration before and after aging. No water penetration at 332 inches (843cm) head of water before aging.

Cyclic Pressure Water Penetration Testing	ASTM E 283 ASTM E 331	No water penetration or evidence of elevated moisture levels in plywood sheathing after 10 cycles of conditioning at 299 Pa (6.24 psf) positive and negative pressure followed by 75 minutes water spray at 6.24 psf (299 Pa) pressure differential with water spray rate of 5 gal/ft <sup>2</sup> -hr (3.4 L/m <sup>2</sup> -min).	No water penetration before and after aging. No water penetration at 332 inches (843cm) head of water before aging.
Water Penetration R-GUARD <sup>™</sup> Spray Wrap (8-in medium wt CMU w/2 coats)	ASTM E 331	No leakage at 137 Pa (2.86 psf) for 15 minutes	No leakage at 137 Pa (2.86 psf) for 15 minutes. No leakage at 300 Pa (6.24 psf) for 120 minutes.
Water Resistance	ASTM D 2247	Absence of deleterious effects	No visible deleterious effects
Testing Resistance to Mold Growth	ASTM D 3273	after 14-day exposure.  No mold growth after 28 days.	after 14-day exposure.  No mold growth after 28-day exposure.
Freeze/Thaw Resistance	ICBO Method (AC 24)	No visible effects (cracking, checking, delamination, erosion) when viewed at 5x.	No visible deleterious effects when viewed at 5x.
Water Vapor Transmission	ASTM E 96 Method B (Water Method)	Measure.	R-GUARD <sup>™</sup> Fill: 17.3 perms [(994 ng/(Pa s m <sup>2</sup> )] R-GUARD <sup>™</sup> Spray Wrap: 5.7 perms [(327 ng/(Pa s m <sup>2</sup> )]
Air Leakage: Wall Assembly with R-GUARD <sup>™</sup> Fill and R-GUARD <sup>™</sup> Spray Wrap	ASTM E 283 (SBCCI PST & ESI Method)	<0.06 cfm/ft <sup>2</sup> at 1.57 psf (0.00030 m <sup>3</sup> /s m <sup>2</sup> at 75 Pa)	0.0044 cfm/ft <sup>2</sup> (0.000022 m <sup>3</sup> /s m <sup>2</sup> )
Air Leakage: R-GUARD <sup>™</sup> Fill	ASTM E 283 (CCMC Technical Guide Method)	<0.003 cfm/ft <sup>2</sup> at 1.57 psf (<0.02 L/s m <sup>2</sup> at 75 Pa)	0.0002 cfm/ft <sup>2</sup> (0.0014 L/s m <sup>2</sup> )
Air Leakage: R-GUARD <sup>™</sup> Spray Wrap (8-in medium wt CMU w/2 coats)	ASTM E 283 (as specified in ASTM E 2178 Section 8.2.8)	<0.004 cfm/ft <sup>2</sup> air leakage at 1.57 psf <0.02 L/s m <sup>2</sup> air leakage at 75 Pa	<sup>2</sup> air leakage at 1.57 psf <sup>2</sup> air leakage at 6.24 psf <sup>2</sup> air leakage at 75 Pa <sup>2</sup> air leakage at 300 Pa

Structural Integrity	ASTM E 330	2-in (51mm) water pressure (positive and negative) for one hour.	No loss of structural integrity.
Dry Tensile Strength	ASTM D 882	20 lbs/in (3503 N/m) minimum before and after aging.	R-GUARD <sup>™</sup> Fill: 159 pli (27.8 kN/m) before aging. 213 pil (37.3 kN/m) after aging.
Flexibility	ASTM D 522	No cracking or delamination using 1/8-in (3mm) mandrel at 14°F (-10°C) before and after aging.	No cracking or delamination before or after aging.
Tensile Adhesion	ASTM C 297	>15 psi (103 kPa)	Gypsum (ASTM C 79): >30 psi (206 kPa) Gypsum (ASTM C 1177): >30 psi (206 kPa) Exposure 1 OSB: >50 psi (344 kPa) Exterior Plywood: >90 psi (620 kPa)
Surface Burning	ASTM E 84	Flame Spread <25 Smoke developed: <450	Flame Spread: 5 Smoke Developed: 10 NFPA Class A, UBC Class 1 building material
Fire Testing	UBC 26-9	No increase in fire hazard.	Pass.

### 1.8 SUBMITTALS

- A. Submit in accordance with Section 013300 Submittals.
- B. Product Data: Submit manufacturer's product data sheets on all products to be used for the work. Submit description for protection, surface preparation, application, and clean-up.
  - 1. Applicator Qualifications: Submit qualifications of applicator.
  - 2. Samples for approval as directed by architect or owner.
  - 3. Prepare and submit project-specific details (when required by contract documents).

#### 1.9 QUALITY ASSURANCE

- A. Manufacturer requirements
  - 1. Manufacturer of masonry treatments for a minimum of 10 years.
- B. Contractor requirements
  - 1. Knowledgeable in the proper use and handling of PROSOCO products.
  - 2. Employ skilled mechanics who are experienced and knowledgeable in air and moisture barrier application, and familiar with the requirements of the specified work.

- 3. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with PROSOCO's published specifications.
- C. Prior to installation, apply air/moisture barrier system as follows to verify details under shop drawing submittals and to demonstrate tie-ins with adjoining construction, and other termination conditions, as well as qualities of materials and execution:

# 1.10 DELIVERY, STORAGE AND HANDLING.

- A. Deliver materials in their original sealed containers bearing manufacturer's name and identification of product.
- B. Protect coatings (pail products) from freezing temperatures and temperatures in excess of 90° F (32° C). Store away from direct sunlight.

#### 1.11 PROJECT/SITE CONDITIONS

- A. Maintain ambient and surface temperatures above 40° F (4° C) during application and drying period, minimum 24 hours after application of air and moisture barrier.
- B. Provide supplementary heat for installation in temperatures less than 40° F (4° C) or if surface temperature is likely to fall below 40° F (4° C). (Note: surface temperature is lower than air temperature at night).
- C. Provide protection of surrounding areas and adjacent surfaces from application of materials

### 1.12 COORDINATION/SCHEDULING

- A. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall.
- B. Provide sill flashing to direct water to the exterior before windows and doors are installed.
- C. Install window and door head flashing immediately after windows and doors are installed.
- D. Install diverter flashings wherever water can enter the assembly to direct water to the exterior.

#### PART 2 PRODUCTS

# 2.1 MANUFACTURER

- 2.2 PROSOCO, INC., 3741 GREENWAY CIRCLE, LAWRENCE, KS 66046, (800) 255-4255,
  - A. Product Description
    - 1. PROSOCO R-GUARD™ is a fluid applied air and moisture barrier that stops air and water leakage through cavity wall, masonry veneer construction. The system consists of adhesive mesh R-GUARD™ Tape, and liquids R-GUARD™ Fill and R-GUARD Spray Wrap.

# 2.3 AIR AND MOISTURE BARRIER

- A. PROSOCO R-GUARD™ Fill: a ready mixed, acrylic air barrier compound for use with PROSOCO R-GUARD™ Tape over cracks, sheathing joints or rough openings through the structural wall.
  - 1. TYPICAL TECHNICAL DATA
    - a. Dark red, viscous liquid, mild odor
    - b. SPECIFIC GRAVITY: >1.0
    - c. TOTAL SOLIDS: 83% ASTM 2369
    - d. pH: 7.5 10.0
    - e. WT./GAL.: 11.9 lbs.
    - f. FLASH POINT: >200 degrees F
    - g. FREEZE POINT: 32 degrees F (0 degrees C)
    - h. VOC: Complies with all known national, state and district AIM VOC regulations.
- B. PROSOCO R-GUARD™ Spray Wrap: a ready mixed, flexible, acrylic coating to be applied to structural sheathing or CMU backup to prevent penetration of liquid water.
  - 1. TYPICAL TECHNICAL DATA
    - a. FORM: light red. viscous liquid, mild odor
    - b. SPECIFIC GRAVITY: >1.0
    - c. TOTAL SOLIDS: 74% ASTM D 2369
    - d. pH: 7.5 10.0
    - e. WT./GAL.: 12.7 lbs.
    - f. FLASH POINT: >200 degrees F
    - g. FREEZE POINT: 32 degrees F (0 degrees C)
    - h. VOC: Complies with all known national, state and district AIM VOC regulations.

#### C. REINFORCING TAPE

 PROSOCO R-GUARD™ Tape: self-adhering, glass fiber, fabric tape for use with PROSOCO R-GUARD™ Fill to reinforce rough openings, inside and outside corners and sheathing points.

SECTION 072726 – FLUID-APPLIED MEMBRANE AIR BARRIERS WYK Associates, Inc. a. Size: 4.25-in and 9.5-in wide self -adhesive, flexible, symmetrical, interlaced glass fiber fabric, with alkaline resistant coating.

# D. EQUIPMENT

- Seam roller or other blunt tool for taping over sheathing joints to firmly adhere mesh tape to backing. To reduce any potential for damaging the mesh tape, round sharp corners of tools used to install R-GUARD™ Tape.
- 2. Rust-free electric drill and paddle for mixing R-GUARD™ Fill and R-GUARD™ Spray Wrap to a uniform consistency.
- 3. Trowel or texture sprayer for applying R-GUARD™ Fill and Spray Wrap. Texture sprayers should have a max working pressure of 100 120 psi (7 8.3 bar) and a max delivery rating of 2.0 4.0 gpm (7.5 15.1 lpm). R-GUARD Fill and R-GUARD Spray Wrap are compatible with GRACO TexSpray™ RTX 1500 and GTX 2000 equipment.

### E. MIXING

- 1. Mix materials with a clean, rust-free electric drill and paddle.
- 2. Do not dilute materials with water or add other ingredients.

#### PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Inspect masonry backup application for compliance with applicable standards.
- B. Report deviations from the requirements of project specifications or other conditions that might adversely affect the air and moisture barrier installation. Do not start work until deviations are corrected.

# 3.2 SURFACE PREPARATION

- A. Remove surface contaminants and replace damaged sheathing.
- B. Spot surface defects in sheathing with joint treatment.
- C. Repair cracks, spalls, or other damage in concrete or concrete masonry surfaces

# 3.3 INSTALLATION

- A. Install waterproofing/air barrier in compliance with manufacturer's written instructions for application to CMU. Thoroughly mix liquids before applying.
- C. Coverages may vary depending on application technique and surface conditions.
- D. Clean up.

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E. Clean tools and equipment water immediately after use. Dried material must be removed mechanically.

# 3.4 FIELD QUALITY CONTROL

- A. Inspection: Inspect the fluid-applied membrane system installation with the Contractor, Architect, applicator, and PROSOCO representative.
- B. Manufacturer's Field Services: Provide the services of a manufacturer's authorized field representative to verify specified products are used, and protection, surface preparation, and installation are in accordance with the manufacturer's written instructions and the mock-ups approved by the Architect.

END OF SECTION 072726

#### SECTION 074213 - METAL WALL PANELS

#### PART 1 GENERAL

# 1.1 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, soffit panels, and subgirt framing assembly, with related flashings and accessory components.

#### 1.2 REFERENCE STANDARDS

- A. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015, with Editorial Revision (2016).

#### 1.3 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.
- C. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches in size illustrating finish color, sheen, and texture.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.

# 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

# 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

### 1.6 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.
- C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals for metal wall panels.

# PART 2 PRODUCTS

# 2.1 MANUFACTURERS

- A. Basis of Design:
  - Metal Wall Panels Concealed Fasteners: Flush Systems manufactured by Dimensional Metals, Inc..
  - 2. Metal Soffit Panels Concealed Fasteners: Flush Systems manufactured by Dimensional Metals, Inc.
- B. Other Acceptable Manufacturers Metal Wall Panels Concealed Fasteners:
  - 1. ATAS International, Inc; Opaline OPF: www.atas.com/#sle.
  - 2. McElroy Metal; MCP: www.mcelroymetal.com/#sle.
  - 3. Substitutions: See Section 016000 Product Requirements.
- C. Metal Soffit Panels:
  - 1. ATAS International, Inc: www.atas.com/#sle.
  - 2. McElroy Metal: www.mcelroymetal.com/#sle.

# 2.2 MANUFACTURED METAL PANELS

- A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
  - 1. Provide exterior wall panels and subgirt framing assembly.
  - 2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
  - 3. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
  - 4. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
  - 5. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
  - 6. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.

7. Corners: Factory-fabricated in one continuous piece with minimum 2 inch returns.

### B. Exterior Wall Panels:

- 1. Profile: Vertical; style as indicated.
- 2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
- 3. Material: Precoated steel sheet, 20 gauge, 0.0359 inch minimum thickness.
- 4. Panel Width: 12 inches.
- 5. Color: As selected by Architect from manufacturer's full line.

# C. Soffit Panels:

- 1. Profile: Flush -Panel.
- 2. Material: Precoated steel sheet, 20 gauge, 0.0359 inch minimum thickness.
- 3. Color: As selected by Architect from manufacturer's full line.

# D. Subgirt Framing Assembly:

- 1. 16 gauge, 0.0598 inch thick formed non-precoated steel sheet.
- E. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.
- F. Expansion Joints: Same material, thickness and finish as exterior sheets; 22 gauge, 0.0299 inch thick; manufacturer's standard brake formed type, of profile to suit system.
- G. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
- H. Anchors: Galvanized steel.

#### 2.3 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

#### 2.4 FINISHES

- A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer's full line..
  - 1. Manufacturers:
    - a. PPG Metal Coatings; Duranar: www.ppgmetalcoatings.com/#sle.
    - b. Substitutions: See Section 016000 Product Requirements.

#### 2.5 ACCESSORIES

- A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.
- B. Concealed Sealants: Non-curing butyl sealant or tape sealant.
- C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
  - Manufacturers:
    - a. Franklin International, Inc; Titebond WeatherMaster Metal Roof Sealant: www.titebond.com/#sle.
    - b. Substitutions: See Section 016000 Product Requirements.
- D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
  - 1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.
- E. Field Touch-up Paint: As recommended by panel manufacturer.

#### PART 3 EXECUTION

# 3.1 EXAMINATION

A. Verify that building framing members are ready to receive panels.

# 3.2 PREPARATION

### 3.3 INSTALLATION

- A. Install panels on walls and soffits in accordance with manufacturer's instructions.
- B. Fasten panels to structural supports; aligned, level, and plumb.
- C. Locate joints over supports.
- D. Lap panel ends minimum 2 inches.
- E. Provide expansion joints where indicated.
- F. Use concealed fasteners unless otherwise approved by Architect.
- G. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

# 3.4 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

# 3.5 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION 074213

# SECTION 075323 - ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING (EPDM)

# PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. EPDM membrane roofing system, including all components specified.
- B. Disposal of demolition debris and construction waste is the responsibility of Contractor. Perform disposal in manner complying with all applicable federal, state, and local regulations.
- C. Comply with the published recommendations and instructions of the roofing membrane manufacturer, at http://manual.fsbp.com.
- D. Commencement of work by Contractor shall constitute acknowledgement by Contractor that this specification can be satisfactorily executed, under the project conditions and with all necessary prerequisites for warranty acceptance by roofing membrane manufacturer. No modification of the Contract Sum will be made for failure to adequately examine the Contract Documents or the project conditions.

# 1.2 RELATED REQUIREMENTS

- A. Section 061000 Rough Carpentry: Wood nailers associated with roofing and roof insulation.
- B. Section 076200 Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

# 1.3 REFERENCE STANDARDS

- A. ANSI/SPRI/FM 4435/ES-1 Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.
- B. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- C. ASTM C208 Standard Specification for Cellulosic Fiber Insulating Board; 2012.
- D. ASTM C209 Standard Test Methods for Cellulosic Fiber Insulating Board; 2015.
- E. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- F. ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2017.

- G. ASTM D1621 Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.
- H. ASTM D1622/D1622M Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2014.
- I. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- J. ASTM D4637/D4637M Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.
- K. ASTM D4811/D4811M Standard Specification for Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing; 2016.
- L. FM (AG) FM Approval Guide; current edition.
- M. FM 4470 Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction; 2016.
- N. PS 20 American Softwood Lumber Standard; 2015.

#### 1.4 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.
- C. Samples: Submit samples of each product to be used.
- D. Executed Warranty.

### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Roofing installer shall have the following:
  - 1. Current approval, license, or authorization as applicator by the manufacturer.
  - 2. At least five years experience in installing specified system.
  - 3. Capability to provide payment and performance bond to building owner.

# 1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering.
- C. Keep combustible materials away from ignition sources.

# 1.7 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

#### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer Roofing System:
  - 1. Carlisle SynTec Incorporated, Carlisle, PA: www.carlislesyntec.com
  - 2. Firestone Building Products LLC, Carmel, IN: www.firestonebpco.com
  - 3. GenFlex Roofing Systems, Indianapolis, IN: www.genflex.com
  - 4. Johns Manville, Denver, CO; www.jm.com
  - 5. Versico Inc., Carlisle, PA: www.versico.com
- B. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.
- C. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.
  - 1. Factory fabricated products by other manufacturers are acceptable provided they are completely equivalent in materials and performance.

### 2.2 ROOFING SYSTEM DESCRIPTION

- A. Roofing System: Ethylene-propylene-diene-monomer (EPDM) single-ply membrane.
  - 1. Membrane Attachment: Fully adhered.
  - 2. Warranty: Membrane warranty; 20 year Roofing Membrane Limited Warranty.
  - 3. Comply with applicable local building code requirements.
- B. Roofing System Components: Listed in order from the top of the roof down:
  - 1. Membrane: 0.60 MIL.
  - 2. Base Sheet Over Insulation: Cold adhesive attached.
  - 3. Insulation:

- a. Maximum Board Thickness: 2 inches; use as many layers as necessary; stagger joints in adjacent layers.
- b. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on top.
- c. Total R-value: 30, continuous minimum.
- d. Top Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
- e. Intermediate Layer(s), If Any: Polyisocyanurate foam board, non-composite; mechanically fastened.
- f. Bottom Layer: Polyisocyanurate foam board, non-composite; mechanically fastened.
- g. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.

#### 2.3 EPDM MEMBRANE MATERIALS

- A. Roofing and Flashing Membrane: Black, cured synthetic single-ply membrane composed of ethylene propylene diene monomer (EPDM) with the following properties:
  - 1. Reinforcement: Polyester weft inserted scrim; membrane complying with ASTM D4637/D4637M Type II.
  - 2. Thickness: 0.060 inch.
  - 3. Nominal Thickness Tolerance: Plus/minus 10 percent.
  - 4. Sheet Width: Provide the widest available sheets to minimize field seaming.
- B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.
- C. Flashing Membrane: Self-curing, non-reinforced membrane composed of nonvulcanized EPDM rubber, complying with ASTM D4811/D4811M Type II, and with the following properties:
  - 1. Thickness: 0.055 inch.
- D. Self-Adhesive Flashing Membrane: Semi-cured 45 mil EPDM membrane laminated to 35 mil EPDM tape adhesive; QuickSeam Flashing by Firestone.
- E. Pre-Molded Pipe Flashings: EPDM, molded for quick adaptation to different sized pipes; EPDM Pipe Flashing.
- F. Self-Adhesive Lap Splice Tape: 35 mil EPDM-based, formulated for compatibility with EPDM membrane and high-solids primer.
- G. Splice Adhesive: Synthetic polymer-based, formulated for compatibility with EPDM membrane and metal surfaces.
- H. Adhesive Primer: Synthetic rubber based primer formulated for compatibility with EPDM membrane and tape adhesive, with VOC content less than 2.1 lb/gal.

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- I. Seam Edge Treatment: EPDM rubber-based sealant, formulated for sealing exposed edges of membrane at seams.
- J. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing.
- K. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed.
- L. Metal Plates and Strips Used for Fastening Membrane and Insulation: Steel with Galvalume coating; corrosion-resistance meeting FM 4470 criteria.
- M. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick.
- N. Roof Walkway Pads: EPDM, 0.30 inch thick by 30 by 30 inches with EPDM tape adhesive strips laminated to the bottom.

# 2.4 ROOF INSULATION AND COVER BOARDS

- A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, with the following additional characteristics:
  - 1. Thickness: As indicated elsewhere.
  - 2. Size: 48 inches by 96 inches, nominal.
    - a. Exception: Insulation to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
  - 3. R-value (LTTR):
    - a. 1.0 inch Thickness: 6.0, minimum.
    - b. 1.5 inch Thickness: 9.0, minimum.
    - c. 1.75 inch Thickness: 10.5, minimum.
    - d. 2.0 inch Thickness: 12.1, minimum.
    - e. 2.3 inch Thickness: 14.0, minimum.
    - f. 2.5 inch Thickness: 15.3, minimum.
  - 4. Compressive Strength: 20 psi when tested in accordance with ASTM C1289.
  - 5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
  - 6. Recycled Content: 19 percent post-consumer and 15 percent pre-consumer (post-industrial), average.
- B. High Density Polyisocyanurate Cover Board: Non-combustible, water resistant, high density closed cell polyisocyanurate core with coated glass mat facers, with the following characteristics:
  - 1. Size: 48 inches by 96 inches, nominal.
  - 2. Thickness: 1/2 inch.

- 3. Thermal Value: R-value of 2.5, when tested in accordance with ASTM C518 and ASTM C177.
- 4. Surface Water Absorption: 3 percent, maximum, when tested in accordance with ASTM C209.
- 5. Compressive Strength: 120 psi, when tested in accordance with ASTM D1621.
- 6. Density: 5 pcf, when tested in accordance with ASTM D1622/D1622M.
- 7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
- 8. Mold Growth Resistance: Passing ASTM D3273.
- C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

#### 2.5 METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.

#### Wind Performance:

- a. Membrane Pull-Off Resistance: 100 lbs/ft, minimum, when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-1.
- b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-2.
- c. Provide product listed in FM (AG) with at least FM 1-270 rating.
- 2. Fascia Face Height: 8-1/2 inches.
- 3. Edge Member Height Above Nailer: 1-1/4 inches.
- 4. Length: 144 inches.
- 5. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
- 6. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
- 7. Anchor Bar Cleat: 20 gauge, 0.036 inch G90 coated commercial type galvanized steel with pre-punched holes.
- 8. Curved Applications: Factory modified.
- 9. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
- 10. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch long legs on corner pieces.
- 11. Scuppers: Welded watertight.
- 12. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

- B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; but type joints with concealed splice plates; mechanically fastened as indicated.
  - Wind Performance:
    - a. At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3.
    - b. Provide product listed in FM (AG) with at least FM 1-90 rating.
  - 2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.
  - 3. Material and Finish: 24 gauge, 0.024 inch thick galvanized steel with Kynar 500 finish in manufacturer's full range of color; matching concealed joint splice plates; factory-installed protective plastic film.
  - 4. Dimensions:
    - a. Wall Width: As indicated on the drawings.
    - b. Piece Length: Minimum 144 inches.
    - c. Curved Application: Factory fabricated in true radius.
  - 5. Anchor/Support Cleats: 20 gauge, 0.036 inch thick prepunched galvanized cleat with 12 inch wide stainless steel spring mechanically locked to cleat at 72 inches on center.
  - 6. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch long legs on corner, intersection, and end pieces.
  - 7. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds for actual substrate used; no exposed fasteners.

### 2.6 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
  - 1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
  - 2. Thickness: Same as thickness of roof insulation.
- B. Cant Strips and Tapered Edge Strips: 45 degree face slope and minimum 5 inch face dimension; provide at all angle changes between vertical and horizontal planes that exceed 45 degrees.
  - 1. Type: Wood fiber, complying with ASTM C208.

# **PART 3 - INSTALLATION**

### 3.1 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.
- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
  - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
  - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
  - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

# 3.2 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

### 3.3 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

#### 3.4 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.
- E. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by membrane manufacturer.

# 3.5 SINGLE-PLY MEMBRANE INSTALLATION

- A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.
- B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.
- C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.
- D. Install membrane adhered to the substrate, with edge securement as specified.
- E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.
- F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
  - 1. Exceptions: Round pipe penetrations less than 18 inches in diameter and square penetrations less than 4 inches square.
  - 2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

# 3.6 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
  - 1. Follow roofing manufacturer's instructions.
  - 2. Remove protective plastic surface film immediately before installation.
  - 3. Install water block sealant under the membrane anchorage leg.
  - 4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
  - 5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
  - 6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.

- 7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.
- E. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 16 inches high above membrane surface.
  - 1. Use the longest practical flashing pieces.
  - 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.
  - 3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
  - 4. Provide termination directly to the vertical substrate as shown on roof drawings.

# F. Roof Drains:

- Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
- 2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch of membrane to extend inside clamping ring past drain bolts.
- 3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
- 4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
- 5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.
- G. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
  - 1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
  - Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side
    of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a
    standard curb with flashing.

# 3.7 FINISHING AND WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.
  - 1. Use specified walkway pads unless otherwise indicated.
  - 2. Install walkway pads after rooftop equipment and accessories, piping and xxxx have been installed.
- B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.
  - 1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
  - 2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

# 3.8 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

# 3.9 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

#### 3.10 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

# END OF SECTION 075323

# SECTION 076200 - SHEET METAL FLASHING AND TRIM

# PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings.
- B. Sealants for joints within sheet metal fabrications.
- C. Precast concrete splash pads.

#### 1.2 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood nailers for sheet metal work.

#### 1.3 REFERENCE STANDARDS

- A. AAMA 2603 Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- B. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.
- C. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM B209M Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
- E. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014a.
- F. ASTM D4586/D4586M Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007, with Editorial Revision (2012).
- G. CDA A4050 Copper in Architecture Handbook; current edition.
- H. SMACNA (ASMM) Architectural Sheet Metal Manual; 2012.

# 1.4 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

# 1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

# 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

# PART 2 PRODUCTS

# 2.1 MANUFACTURERS

- A. Sheet Metal Flashing and Trim Manufacturers:
  - 1. Fairview Architectural LLC: www.fairview-na.com/#sle.
  - 2. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
  - 3. Dimensional Metals, Inc: www.dmimetals.com
  - 4. McElroy Metal: www.mcelroymetal.com
  - 5. Substitutions: See Section 016000 Product Requirements.

#### 2.2 SHEET MATERIALS

- A. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 20 gauge, 0.032 inch thick; plain finish shop pre-coated with modified silicone coating.
  - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.
  - 2. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
  - 3. Color: As selected by Architect from manufacturer's full colors.

# 2.3 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

#### GSD-221-C

- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

# 2.4 GUTTER AND DOWNSPOUT FABRICATION

- A. Downspouts: Rectangular profile.
- B. Downspout Boots: Plastic.
- C. Downspout Extenders: Same material and finish as downspouts.
- D. Seal metal joints.

#### 2.5 ACCESSORIES

- A. Fasteners: Galvanized steel, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.
- F. Reglets: Recessed type, galvanized steel; face and ends covered with plastic tape.

# PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

# 3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

#### GSD-221-C

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

#### 3.3 INSTALLATION

- A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.
- E. Secure gutters and downspouts in place with concealed fasteners.
- F. Connect downspouts to downspout boots, and grout connection watertight.
- G. Set splash pads under downspouts.

END OF SECTION 076200

#### SECTION 078413 - PENETRATION FIRESTOPPING

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. Drawings and General notes apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Only tested firestop systems shall be used in specific locations as follows:
  - 1. Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.
  - 2. Gaps between the top of walls and ceilings or roof assemblies.
  - 3. Openings and penetrations in fire-rated partitions or walls containing fire doors.
  - 4. Openings around structural members which penetrate floors or walls.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
  - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For qualified Installer.
- D. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A supplier's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- B. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.
- C. Firestop System installation must meet requirements of ASTM E-814, UL 1479 or UL 2079 tested assemblies that provide a fire rating equal to that of construction being penetrated.
- D. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- E. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- F. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (as may be amended from time to time).

# 1.5 REFERENCE

- A. Test Requirements: ASTM E-814-02, "Standard Method of Fire Tests of Through Penetration Fire Stops"
- B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
  - 1. UL Fire Resistance Directory:
    - a. Firestop Devices (XHJI)
    - b. Fire Resistance Ratings (BXUV)
    - c. Through-Penetration Firestop Systems (XHEZ)
    - d. Fill, Voids, or Cavity Material (XHHW)
    - e. Forming Materials (XHKU)

- 2. Alternate "Omega Point Laboratories Directory (updated annually).
- C. Test Requirements: UL 2079, "Tests for Fire Resistance of Building Joint Systems" (July 1998.)
- D. Test Requirements: ASTM E 1966-01, "Standard test method for Fire Resistive Joint Systems.
- E. Inspection Requirements: ASTM E 2174 01, "Standard Practice for On-site Inspection of Installed Fire Stops.
- F. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- G. ASTM E-84-01, Standard Test Method for Surface Burning Characteristics of Building Materials.
- H. All major codes: IBC

# 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

# 1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

# 1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
  - 1. A/D Fire Protection Systems Inc.
  - 2. Grace Construction Products.
  - 3. Hilti, Inc.
  - 4. Specified Technologies Inc.
  - 5. 3M Fire Protection Products.
  - 6. Tremco, Inc.; Tremco Fire Protection Systems Group.

# 2.2 PENETRATION FIRESTOPPING-GENERAL

- A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

# 2.3 MATERIALS

- A. Use only firestop products that have been UL 1479, ASTM E-814, or UL 2079 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- B. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
  - 1. Hilti FS-ONE Intumescent Firestop Sealant
  - 2. Hilti CP 604 Self-leveling Firestop Sealant
  - 3. Hilti CP 620 Fire Foam
  - 4. Hilti CP 606 Flexible Firestop Sealant
  - 5. Hilti CP 601s Elastomeric Firestop Sealant
- C. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:
  - 1. Hilti CP 601s Elastomeric Firestop Sealant
  - 2. Hilti CP 606 Flexible Firestop Sealant
  - 3. Hilti FS-ONE Intumescent Firestop Sealant

- D. Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps, the following products are acceptable:
  - 1. Hilti CP 672 Speed Spray
  - 2. Hilti CP 601s Elastomeric Firestop Sealant
  - 3. Hilti CP 606 Flexible Firestop Sealant
  - 4. Hilti CP 604 Self-leveling Firestop Sealant
- E. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
  - 1. Hilti FS-ONE Intumescent Firestop Sealant
- F. Foams, intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti FS-ONE Intumescent Firestop Sealant
  - 2. Hilti CP 618 Firestop Putty Stick
  - 3. Hilti CP 620 Fire Foam
  - 4. Hilti CP 601s Elastomeric Firestop Sealant
  - 5. Hilti CP 606 Flexible Firestop Sealant
- G. Non-curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
  - 1. Hilti CP 618 Firestop Putty Stick
- H. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
  - 1. Hilti CP 617 Firestop Putty Pad
- I. Materials used for complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - 1. Hilti CP 637 Trowelable Firestop Compound
  - 2. Hilti FS 657 FIRE BLOCK
  - 3. Hilti CP 620 Fire Foam
- J. Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
  - Hilti FS 657 FIRE BLOCK
- K. Sealants or caulking materials used for openings between structurally separate sections of wall and floors, the following products are acceptable:
  - 1. Hilti CP 672 Speed Spray

- 2. Hilti CP 601s Elastomeric Firestop Sealant
- 3. Hilti CP 606 Flexible Firestop Sealant
- 4. Hilti CP 604 Self-Leveling Firestop Sealant
- L. Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E814 which is equal to the time rating of construction being penetrated.
- M. Provide a firestop system with an Assembly Rating as determined by UL 2079 which is equal to the time rating of construction being penetrated.

#### 2.4 FILL MATERIALS

- A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of non-sag grade for both opening conditions.

#### 2.5 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

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

# 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

# 3.3 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

# 3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning Penetration Firestopping Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - Manufacturer's name.
  - Installer's name.

# 3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

**END OF SECTION 078413** 

# SECTION 078443 - JOINT FIRESTOPPING

# PART 1 GENERAL

#### 1.1 SECTION INCLUDES

A. Firestopping systems.

# 1.2 REFERENCE STANDARDS

- A. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- B. ITS (DIR) Directory of Listed Products; current edition.
- C. FA (AG) FM Approval Guide; Factory Mutual Research Corporation; current edition.
- D. UL (FRD) Fire Resistance Directory; current edition.

#### 1.3 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- C. Testing Agency Reports.

# 1.4 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. With minimum 3 years documented experience installing work of this type.

# 1.5 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

#### PART 2 PRODUCTS

# 2.1 FIRESTOPPING - GENERAL REQUIREMENTS

# A. Manufacturers:

- 1. A/D Fire Protection Systems Inc.: www.adfire.com.
- 2. 3M Fire Protection Products: www.3m.com/firestop.
- 3. Hilti, Inc: www.us.hilti.com/#sle.
- 4. Nelson FireStop Products: www.nelsonfirestop.com.
- 5. Specified Technologies, Inc.: www.stifirestop.com.
- 6. Substitutions: See Section 016000 Product Requirements.
- B. Mold Resistance: Provide firestoppping materials with mold and mildew resistance rating of 0 as determined by ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

# 2.2 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION

# A. Blank Openings:

- 1. In Floors:
  - a. 1 Hour Construction: UL System C-AJ-0090; Hilti FS-ONE MAX Intumescent Firestop Sealant.
- B. Penetrations Through Floors or Walls By:
  - 1. Multiple Penetrations in Large Openings:
    - a. 2 Hour Construction: UL System C-AJ-8143: Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 2. Uninsulated Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System C-AJ-1226; Hilti FS-ONE MAX Intumescent Firestop Sealant.
  - 3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
    - a. 2 Hour Construction: UL System C-AJ-2109; Hilti CP 643N/644 Firestop Collar.
  - 4. Electrical Cables Not In Conduit:
    - a. 2 Hour Construction: UL System W-J-3199; Hilti CFS-SL SK Firestop Sleeve Kit.
  - 5. Cable Trays with Electrical Cables:
    - a. 2 Hour Construction: UL System C-AJ-4094; Hilti CFS-BL Firestop Block.
  - 6. Insulated Pipes:
    - a. 2 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE IMAX intumescent Firestop Sealant.
  - 7. HVAC Ducts, Uninsulated:
    - a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

# PART 3 EXECUTION

# 3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

# 3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.

# 3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.
- D. Do not caulk perimeter of fire dampers to wall with fire caulking/tumescent material.

# 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage Inspection agency to examine penetration firestopping in accordance with ASTM E2174, 93Standard Practice for On-Site Inspection of Installed Fire Stops and ASTM E2393, 93Standard Practice for On-Site Inspection of Installed Fire Stop Joint Systems.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

# 3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

# 3.6 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

# **END OF SECTION**

#### SECTION 079200 - JOINT SEALANTS

# PART 1 - GENERAL

# 1.1 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

# 1.2 REFERENCE STANDARDS

- A. ASTM C794 Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2015a.
- B. ASTM C919 Standard Practice for Use of Sealants in Acoustical Applications; 2012 (Reapproved 2017).
- C. ASTM C920 Standard Specification for Elastomeric Joint Sealants; 2014a.
- D. ASTM C1087 Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.
- E. ASTM C1193 Standard Guide for Use of Joint Sealants; 2016.
- F. ASTM C1248 Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).
- G. ASTM C1330 Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).
- H. ASTM C1521 Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

# 1.3 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
  - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
  - 2. List of backing materials approved for use with the specific product.

- 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
- 4. Substrates for which use of primer is required.
- 5. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
- 6. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.
- F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- G. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- H. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- I. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- J. Installation Log: Submit filled out log for each length or instance of sealant installed.
- K. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.
- L. Manufacturer's Qualification Statement.
- M. Installer's Qualification Statement.

# 1.4 QUALITY ASSURANCE

- A. Maintain one copy of each referenced document covering installation requirements on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

- C. Installer Qualifications: Company specializing in performing the work of this section and with at least five years of documented experience and approved by manufacturer.
- D. Field Quality Control Plan:
  - 1. Visual inspection of entire length of sealant joints.
  - 2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
- E. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

# 1.5 WARRANTY

- A. See Section 017800 Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a three year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
  - 1. Adhesives Technology Corporation; : www.atcepoxy.com.
  - 2. BASF Construction Chemicals-Building Systems; : www.buildingsystems.basf.com.
  - 3. Bostik Inc;: www.bostik-us.com.
  - 4. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
  - 5. Fortifiber Building Systems Group: www.fortifiber.com/#sle.
  - 6. Franklin International. Inc:: www.titebond.com.
  - 7. Hilti, Inc;: www.us.hilti.com/#sle.
  - 8. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com/#sle.
  - 9. Pecora Corporation; : www.pecora.com.
  - 10. The QUIKRETE Companies; : www.quikrete.com.
  - 11. Tremco Global Sealants; : www.tremcosealants.com.
  - 12. Sherwin-Williams Company; : www.sherwin-williams.com.
  - 13. Sika Corporation; : www.usa-sika.com.
  - 14. W.R. Meadows, Inc;: www.wrmeadows.com.
  - 15. Substitutions: See Section 016000 Product Requirements.

- B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
  - 1. BASF Construction Chemicals-Building Systems; : www.buildingsystems.basf.com.
  - 2. Bostik Inc;: www.bostik-us.com.
  - 3. Dayton Superior Corporation; : www.daytonsuperior.com.
  - 4. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
  - 5. Pecora Corporation; : www.pecora.com.
  - 6. Tremco Global Sealants; : www.tremcosealants.com.
  - 7. Sika Corporation; : www.usa-sika.com.
  - 8. W.R. Meadows, Inc; : www.wrmeadows.com.
  - 9. Substitutions: See Section 016000 Product Requirements.

# 2.2 JOINT SEALANT APPLICATIONS

# A. Scope:

- 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
  - a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Openings below ledge angles in masonry.
  - e. Other joints indicated below.
- Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
  - a. Joints between door, window, and other frames and adjacent construction.
  - b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
  - c. Other joints indicated below.
- 3. Do not seal the following types of joints.
  - a. Intentional weepholes in masonry.
  - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
  - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed
  - d. Joints where installation of sealant is specified in another section.

- e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
  - 1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
  - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
  - 2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.

# 2.3 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
  - 1. Movement Capability: Plus and minus 50 percent, minimum.
  - 2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
  - 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
  - 4. Color: To be selected by Architect from manufacturer's standard range.
  - 5. Cure Type: Single-component, neutral moisture curing.
  - 6. Service Temperature Range: Minus 65 to 180 degrees F.
  - 7. Manufacturers:
    - a. Dow Corning Corporation; 756 SMS Building Sealant: www.dowcorning.com/construction/#sle.
    - b. Dow Corning Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction/#sle.
    - c. Dow Corning Corporation; 791 Silicone Weatherproofing Sealant: www.dowcorning.com/construction/#sle.
    - d. Dow Corning Corporation; 795 Silicone Building Sealant: www.dowcorning.com/construction/#sle.
    - e. Pecora Corporation; 890NST Ultra Low Modulus Architectural Silicone Sealant Class 100: www.pecora.com/#sle.
    - f. Pecora Corporation; 890FTS Field Tintable Ultra Low Modulus Architectural Silicone Sealant Class 100: www.pecora.com.
    - g. Pecora Corporation; 890FTS-TXTR Field Tintable Textured Ultra Low Modulus Architectural Silicone Sealant Class 50: www.pecora.com.
    - h. Pecora Corporation; 864NST Low Modulus Architectural Silicone Sealant Class 50: www.pecora.com.
    - Pecora Corporation; 895NST Medium Modulus Structural Glazing & Weatherproofing Silicone Sealant - Class 50: www.pecora.com.
    - j. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
    - k. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.

- I. Sika Corporation; Sikasil 728NS: www.usa-sika.com/#sle.
- m. Substitutions: See Section 016000 Product Requirements.

# 2.4 SELF-LEVELING SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion.
  - 1. Movement Capability: Plus and minus 25 percent, minimum.
  - 2. Color: To be selected by Architect from manufacturer's standard range.
  - 3. Service Temperature Range: Minus 40 to 180 degrees F.
  - 4. Manufacturers:
    - a. BASF Construction Chemicals-Building Systems; [None N/A]: www.buildingsystems.basf.com.
    - b. Bostik Inc.: www.bostik-us.com
    - c. Dayton Superior Corporation: www.daytonsuperior.com
    - d. Dow Corning Corporation: www.dowcorning.com/construction/#sle
    - e. Pecora Corporation: www.pecora.com
    - f. Tremco Global Sealants: www.tremcosealants.com
    - g. Sika Corporation: www.usa-sika.com
    - h. W.R. Meadows, Inc.: www.wrmeadows.com
    - i. Substitutions: See Section 016000 Product Requirements.
- B. Rigid Self-Leveling Polyurethane Joint Filler: Two part, low viscosity, fast setting; intended for cracks and control joints not subject to significant movement.
  - 1. Hardness Range: Greater than 100, Shore A, and 50 to 80, Shore D, when tested in accordance with ASTM C661.
  - 2. Manufacturers:
    - a. ARDEX Engineered Cements; ARDEX ARDIFIX: www.ardexamericas.com/#sle.
    - b. Substitutions: See Section 016000 Product Requirements.

# 2.5 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
  - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O Open Cell Polyurethane.
  - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B Bi-Cellular Polyethylene.

- 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
- 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
  - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
  - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
  - 3. Record each test on Preinstallation Adhesion Test Log as indicated.
  - 4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
  - 5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

# 3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

# 3.3 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Install bond breaker backing tape where backer rod cannot be used.
- E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

#### 3.4 FIELD QUALITY CONTROL

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.
- C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.
- D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
- E. Repair destructive test location damage immediately after evaluation and recording of results.

# 3.5 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

**END OF SECTION** 

# **DIVISION** 8 OPENINGS

# SECTION 087100 - DOOR HARDWARE

# PART 1 GENERAL

# 1.1 SECTION INCLUDES

- A. Hardware for hollow metal doors.
- B. Electrically operated and controlled hardware.
- C. Thresholds.
- D. Weatherstripping and gasketing.

# 1.2 RELATED REQUIREMENTS

- A. Section 079200 Joint Sealants: Sealants for setting exterior door thresholds.
- B. Section 081113 Hollow Metal Doors and Frames.
- C. Section 281000 Access Control: Electronic access control devices.

# 1.3 REFERENCE STANDARDS

- A. BHMA A156.1 American National Standard for Butts and Hinges; 2016.
- B. BHMA A156.3 American National Standard for Exit Devices; 2014.
- C. BHMA A156.4 American National Standard for Door Controls Closers; 2013.
- D. BHMA A156.18 American National Standard for Materials and Finishes; 2016.
- E. BHMA A156.21 American National Standard for Thresholds; 2014.
- F. BHMA A156.22 American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2017.
- G. NFPA 70 National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 80 Standard for Fire Doors and Other Opening Protectives; 2016.
- I. UL (DIR) Online Certifications Directory; current listings at database.ul.com.

# 1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

# 1.5 SUBMITTALS

- A. See Section 013000 Administrative Requirements for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
  - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
  - 2. Provide complete description for each door listed.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Supplier's qualification statement.

# 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

# 1.7 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

# 1.8 WARRANTY

- A. See Section 017800 Closeout Submittals for additional warranty requirements.
- B. Manufacturer's Warranty: Provide warranty against defects in material and workmanship for period indicated. Complete forms in Owner's name and register with manufacturer.
  - 1. Locksets and Cylinders: Three years, minimum.
  - 2. Other Hardware: Two years, minimum.

# PART 2 PRODUCTS

# 2.1 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
  - 1. Applicable provisions of federal, state, and local codes.
  - Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
  - 1. See Section 281000 for additional access control system requirements.
- E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.

# F. Fasteners:

- 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
  - a. Aluminum fasteners are not permitted.
  - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
- 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
  - a. Self-drilling (Tek) type screws are not permitted.
- 3. Provide wall grip inserts for hollow wall construction.
- 4. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
- 5. Fire-Rated Applications: Comply with NFPA 80.
  - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
  - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

# 2.2 HINGES

#### A. Manufacturers:

- 1. Basis of Design: Ives, an Allegion brand; www.allegion.com/us/#sle..
- 2. McKinney; an Assa Abloy Group company: www.assaabloydss.com/#sle.
- 3. Bommer Industries, Inc: www.bommer.com/#sle.
- 4. Hager Companies: www.hagerco.com/#sle.

- B. Hinges: Comply with BHMA A156.1, Grade 1.
  - 1. Provide hinges on every swinging door.
  - 2. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
  - 3. Provide non-removable pins on exterior outswinging doors.
  - 4. Provide following quantity of butt hinges for each door:
    - a. Doors From 60 inches High up to 90 inches High: Three hinges.

# 2.3 EXIT DEVICES

# A. Manufacturers:

- 1. Corbin Russwin; an Assa Abloy Group company: www.assaabloydss.com/#sle.
- 2. Hager Companies: www.hagerco.com/#sle.
- 3. Von Duprin, an Allegion brand: www.allegion.com/us/#sle.
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
  - 1. Lever design to match lockset trim.
  - 2. Provide cylinder with cylinder dogging or locking trim.
  - 3. Provide exit devices properly sized for door width and height.
  - 4. Provide strike as recommended by manufacturer for application indicated.
  - 5. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
  - 6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

# 2.4 CLOSERS

- A. Manufacturers; Surface Mounted:
  - 1. Basis of Design: LCN, an Allegion brand; www.allegion.com/us/#sle..
  - 2. DORMA USA, Inc; : www.dorma.com/#sle.
  - 3. Hager Companies: www.hagerco.com/#sle.
- B. Closers: Comply with BHMA A156.4, Grade 1.
  - 1. Type: Surface mounted to door.
  - 2. Provide door closer on each exterior door.

# 2.5 KICK PLATES

# A. Manufacturers:

- 1. Basis of Design: Rockwood; an Assa Abloy Group company; www.assaabloydss.com/#sle.
- 2. Ives, an Allegion brand: www.allegion.com/us/#sle.
- B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
  - 1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

# 2.6 THRESHOLDS

#### A. Manufacturers:

- 1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
- 2. National Guard Products, Inc: www.ngpinc.com/#sle.
- 3. Reese Enterprises, Inc: www.reeseusa.com/#sle.

# B. Thresholds: Comply with BHMA A156.21.

- 1. Provide threshold at each exterior door, unless otherwise indicated.
- 2. Type: Flat surface.
- 3. Material: Aluminum.
- 4. Threshold Surface: Fluted horizontal grooves across full width.
- 5. Field cut threshold to profile of frame and width of door sill for tight fit.
- 6. Provide non-corroding fasteners at exterior locations.

# 2.7 WEATHERSTRIPPING AND GASKETING

# A. Manufacturers:

- 1. Pemko; an Assa Abloy Group company: www.assaabloydss.com/#sle.
- 2. National Guard Products, Inc: www.ngpinc.com/#sle.
- 3. Reese Enterprises, Inc: www.reeseusa.com/#sle.

# B. Weatherstripping and Gasketing: Comply with BHMA A156.22.

- 1. Head and Jamb Type: Adjustable.
- 2. Door Sweep Type: Encased in retainer.
- 3. Material: Aluminum, with brush weatherstripping.

# 2.8 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
  - 1. Primary Finish: 689; aluminum painted, with any base material (former US equivalent US28); BHMA A156.18.

# PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

#### 3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.

- C. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
- D. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

# 3.3 ADJUSTING

- A. Adjust work under provisions of Section 017000 Execution and Closeout Requirements.
- B. Adjust hardware for smooth operation.
- C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

# 3.4 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

# 3.5 PROTECTION

- A. Protect finished Work under provisions of Section 017000 Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

# PART 4 DOOR HARWARE SETS

# 4.1 DESCRIPTION

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
  - 1. Quantities listed are for each pair of doors, or for each single door.
  - 2. The supplier is responsible for handing and sizing all products.
  - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

# B. Manufacturer's Abbreviations:

- 1. PE Pemko
- 2. SCH Schlage
- 3. RO Rockwood
- 4. SU Securitron
- 5. VD Von Duprin
- 6. IVE Ives
- 7. RO Rockwood
- 8. LCN LCN
- 9. OT Others

# 4.2 HARDWARE SETS

SET 1

**DOOR 101/A** 

Description: EXT - PR- HMD - CVR - CR

<u>EA</u> .	<u>ITEM</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFR</u>
6	Hinge, Full Mortise, Hvy Wt	5BB1 HW NRP	US32D	IVE
1	Electric Power Transfer	EL-CEPT	630	SU
2	Concealed Vert Rod Exit, Exit Only	9847 EO	US32D	VD
1	Schlage Access Control Trim	To Match Building Standard	US32D	SCH
2	Surface Closer	4040XP SCUSH.	689	LCN
2	Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
1	Threshold	271A (Or as detailed)		PE
1	Gasketing	S773D		PE
1	Rain Guard	346C		PE
1	Power Supply	As Required		OT
2	Door Position Switch	As Required		OT

Notes: Door normally closed and locked. Entry by valid card read or manual key override. Free egress at all times.

SET 2

**DOOR 101/B** 

Description: EXT - SGL- HMD - CVR - CR

<u>EA.</u>	<u>ITEM</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFR</u>
3	Hinge, Full Mortise, Hvy Wt	5BB1 HW NRP	US32D	IVE
1	Electric Power Transfer	EL-CEPT		SU
1	Rim Exit Device, Exit Only	98 EO	US32D	VD
1	Schlage Access Control Trim	To Match Building Standard	US32D	SCH
1	Surface Closer	4040XP SCUSH.		LCN
1	Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
1	Threshold	271A (Or as detailed)		PE
1	Gasketing	S773D		PE
1	Rain Guard	346C		PΕ
1	Power Supply	As Required		OT
1	Door Position Switch	As Required		OT

Notes: Door normally closed and locked. Entry by valid card read or manual key override. Free egress at all times.

SET 3 DOOR 101/C

<u>EA.</u>	<u>ITEM</u>	<u>DESCRIPTION</u>	<u>FINISH</u>	<u>MFR</u>
6	Hinge, Full Mortise, Hvy Wt	5BB1 HW NRP	US32D	IVE
1	Electric Power Transfer	EL-CEPT	630	SU
2	Concealed Vert Rod Exit, Exit Only,	9847 EO	US32D	VD
	No bottom			
1	Schlage Access Control Trim	To Match Building Standard	US32D	SC
2	Surface Closer	4040XP SCUSH.	689	LCN
2	Kick Plate	K1050 10" x 1" LDW CSK BEV	US32D	RO
2	Rain Guard	346C		PE
1	Power Supply	As Required		OT
2	Door Position Switch	As Required		OT

Notes: Door normally closed and locked. Entry by valid card read or manual key override. Free egress at all times.

**END OF SECTION** 

# DIVISION 9 FINISHES

# **SECTION 099113 - EXTERIOR PAINTING**

# PART 1 GENERAL

# 1.1 RELATED DOCUMENTS

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

# 1.2 SUMMARY

- A. Section includes:
  - Primers.
  - 2. Finish coatings.

# 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include preparation requirements and application instructions.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches (200 mm) square.
  - 2. Apply coats on Samples in steps to show each coat required for system
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.

# 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. Paint Products: 5 percent, but not less that 1 gal. (3.8 L) of each material and color applied.

# 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less that 45 deg F (7 deg C).
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rages and waste from storage areas daily.

# 1.6 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).
- B. Do not apply paints in snow, rain, fog or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew paint; or to damp or wet surfaces.

# PART 2 PRODUCTS

# 2.1 MANUFACTURERS

- B. Paints:
  - 1. Sherwin-Williams.
  - 2. Glidden Professional.
  - 3. PPG.
  - 4. Benjamin Moore.
- C. Source Limitations: Obtain each paint product from single source from single manufacturer.

# 2.2 PAINTS PRODUCTS - GENERAL

- A. Material Compatibility:
  - Provide materials for use within each paint system that are 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, provide products recommended in writing by topcoat manufacturer for use in paint system and on substrate indicated.
- B. Colors: As selected by Architect from manufacturer's full range.

# 2.3 PRIMERS

- A. Water-Based, Galvanized-metal Primer: Corrosion-resistant, pigmented, acrylic primer; formulated for use on cleaned/etched, exterior, galvanized metal to prepare it for subsequent water-based coatings.
  - 1. Sherwin-Williams Pro-Industrial Pro-Cryl Universal Primer.

# 2.4 FINISH COATINGS

A. Exterior, Water-Based, Light Industrial Coating, Low Sheen; Corrosion-resistant, water-based, pigmented, emulsion coating formulated for resistance to blocking (sticking of two

SECTION 099113 - EXTERIOR PAINTING

painted surfaces), water, alkalis, moderate abrasion, and mild chemical exposure and for use on exterior, primed, wood and metal surfaces.

- 1. Sherwin-Willimas Pro-Industrial Acrylic Semi-Gloss.
- 2. Gloss and Sheen Level: Manufacturer's standard semi-gloss finish.

# PART 3 EXECUTION

# 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with finishes and primers.
- C. 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 applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems specified in this Section.
- D. Steel Substrates: Remove rust, loose mill scale and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

# 3.3 INSTALLATION

- A. Apply paints in accordance with manufacturer's written instructions.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  - 3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating or nomenclature plates.
  - 5. Primers specified in the Exterior Painting Schedule may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat paint manufacturers.
- B. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats o4r other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

# 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
  - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional costs as needed to provide dry film thickness that complies with paint manufacturer's written instructions.

# 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags and other discarded materials from Project site.
  - 1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems and ground.
  - 2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
  - 3. Allow empty paint cans to dry before disposal.

- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

# 3.6 EXTERIOR PAINTING SCHEDULE

- A. Galvanized-Metal Substrates:
  - 1. Water-Based, Light Industrial coating System:
    - a. Prime Coat: Water-based, galvanized-metal primer.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Exterior, water-based, light industrial coating, low sheen.

END OF SECTION 099113

#### SECTION 099123 - INTERIOR PAINTING

#### PART 1 GENERAL

# 1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, and varnishes.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Prime surfaces to receive wall coverings.
  - 2. Mechanical and Electrical:
    - a. In finished areas, paint conduit, boxes, and mechanical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Floors, unless specifically indicated.
  - 6. Glass.
  - 7. Concealed pipes, ducts, and conduits.

# 1.2 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

# 1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

#### 1.4 REFERENCE STANDARDS

- A. ASTM D16 Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- B. ASTM D4442 Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2016.

- C. MPI (APSM) Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- D. SSPC-SP 1 Solvent Cleaning; 2015, with Editorial Revision (2016).
- E. SSPC-SP 6 Commercial Blast Cleaning; 2007.
- F. SSPC-SP 13 Surface Preparation of Concrete; 1997 (Reaffirmed 2003).

# 1.5 SUBMITTALS

- A. See Section 013000 Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  - 2. MPI product number (e.g. MPI #47).
  - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit two paper chip samples, 4 by 4 inch in size illustrating range of colors and textures available for each surface finishing product scheduled.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 Product Requirements, for additional provisions.
  - 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
  - 3. Label each container with color in addition to the manufacturer's label.

# 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years experience.

# 1.7 MOCK-UP

- A. See Section 014000 Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 8 feet long by 8 feet wide, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by Architect.
- E. Mock-up may remain as part of the work.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

## 1.9 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

## B. Paints:

- 1. Base Manufacturer: Sherwin Williams. See Finish Schedule for Basis-Of-Design for Paint Colors, Products and Sheen.
- 2. Behr Process Corporation: www.behr.com/#sle.
- 3. Benjamin Moore & Co: www.benjaminmoore.com.
- 4. Diamond Vogel Paints: www.diamondvogel.com/#sle.
- 5. Duron, Inc: www.duron.com.
- 6. PPG Paints: www.ppgpaints.com/#sle.
- 7. Pratt & Lambert Paints: www.prattandlambert.com/#sle.
- 8. Rodda Paint Co: www.roddapaint.com/#sle.
- 9. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 016000 Product Requirements.

## 2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

- 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
- 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
- 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Colors: As indicated on drawings.
  - 1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

## 2.3 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, and galvanized steel.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Interior Latex; MPI #43, 44, 52, 53, 54, or 114.
    - a. Products:
      - 1) Behr Marquee Interior Eggshell Enamel [No.2450]. (MPI #52)
      - 2) Behr Pro i300 Interior Eggshell Paint [No.330]. (MPI #44)
      - 3) Pratt & Lambert Accolade Interior, Satin.
      - 4) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #44)
  - 3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
    - b. Eggshell: MPI gloss level 3; use this sheen for gypsum board and plaster walls.
    - c. Semi-Gloss: MPI gloss level 5; use this sheen for CMU Walls, railings and door frames.
- B. Paint I-OP-MD-DT Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  - 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  - 2. Two top coats and one coat primer.
  - 3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
    - a. Products:
      - Sherwin-Williams Pro Industrial Waterbased Catalyzed Epoxy, Gloss. (MPI #115)
      - 2) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
      - 3) Substitutions: Section 016000 Product Requirements.
- C. Paint I-OP-MD-WC Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
  - 1. Two top coats and one coat primer.

- D. Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, and galvanized conduit.
  - 1. Shop primer by others.
  - 2. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
    - a. Products:
      - 1) PPG Paints Speedhide Super Tech Water Based Interior Dry-Fog, 6-724XI, Semi-Gloss.
      - 2) Pratt & Lambert Waterborne Dry Fall, Semi-Gloss (MPI #155, 226)
      - 3) Sherwin-Williams Waterborne Acrylic Dryfall, Semi-Gloss. (MPI #226)
  - 3. Top Coat Sheen:
    - a. Semi-Gloss: MPI gloss level 5; use this sheen at all locations.
  - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- E. Paint I-OP-FL Concrete and Wood Floors to be Painted.
  - 1. Two top coats and one coat primer.
  - 2. Top Coat(s): Latex Floor Paint, Low Gloss; MPI #60.
    - a. Products:
      - 1) Behr Premium Interior/Exterior Porch and Patio Floor Paint, Low-Lustre [No. 6050].
      - 2) Pratt & Lambert WithSTAND Latex Floor Enamel, Eggshell.
      - 3) Sherwin-Williams Tread-Plex Acrylic Floor Coating. (MPI #60)
      - 4) Substitutions: Section 016000 Product Requirements.
  - 3. Top Coat Sheen:
    - a. Gloss: MPI gloss level 6; use this sheen at all locations.
  - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- F. Paint WI-OP-3L Wood, Opaque, Latex, 3 Coat:
  - 1. One coat of latex primer sealer.
  - 2. Semi-gloss: Two coats of latex enamel.
- G. Paint CI-OP-3L Concrete/Masonry, Opaque, Latex, 3 Coat:
  - 1. One coat of block filler.
  - 2. Semi-gloss: Two coats of latex enamel.
- H. Paint MI-OP-3L Ferrous Metals, Unprimed, Latex, 3 Coat:
  - 1. One coat of latex primer.
  - 2. Gloss: Two coats of latex enamel.
- I. Paint MI-OP-2A Ferrous Metals, Primed, Alkyd, 2 Coat:
  - 1. Touch-up with alkyd primer.
  - 2. Semi-gloss: Two coats of alkyd enamel.
- J. Paint MgI-OP-3L Galvanized Metals, Latex, 3 Coat:
  - 1. One coat galvanize primer.
  - 2. Semi-gloss: Two coats of latex enamel.
- K. Paint GI-OP-3L Gypsum Board/Plaster, Latex, 3 Coat:
  - 1. One coat of Latex primer sealer.
  - 2. Eggshell: Two coats of latex enamel; .

## 2.4 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
  - 1. Interior/Exterior Latex Block Filler; MPI #4.
    - a. Products:
      - 1) Kilz Pro-X p50 Block Filler Primer.
      - 2) PPG Paints Speedhide Masonry Hi Fill Latex Block Filler, 6-15. (MPI #4)
      - 3) Pratt & Lambert Acrylic Block Filler.
      - 4) Pratt & Lambert Pro-Hide Silver Interior/Exterior Latex Block Filler.
      - 5) Rodda Sprayable Block Filler, 501901. (MPI #4)
      - 6) Substitutions: Section 016000 Product Requirements.
  - 2. Interior Latex Primer Sealer; MPI #50.
    - a. Products:
      - 1) Behr Premium Plus Interior All-In-One Primer and Sealer [No. 75]. (MPI #50)
      - 2) PPG Paints Speedhide Interior Latex Sealer, 6-2. (MPI #50)
      - 3) PPG Paints Speedhide zero Interior Latex Sealer, 6-4900XI. (MPI #50)
      - 4) Pratt & Lambert Multi-Purpose Waterborne Primer. (MPI #50)
      - 5) Rodda Roseal II, 502701. (MPI #50)
      - 6) Substitutions: Section 016000 Product Requirements.
  - 3. Interior Drywall Primer Sealer.
    - a. Products:
      - 1) Behr Premium Plus Interior Drywall Primer and Sealer [No. 73].
      - 2) Pratt & Lambert Drywall Primer.
      - 3) Rodda Vapor Block Interior Perm Rated Latex Primer/Sealer, 507901.
      - 4) Substitutions: Section 016000 Product Requirements.
  - 4. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
    - a. Available Products:
      - 1) Pratt & Lambert Alkyd Shopcoat Primer, OTC Compliant. (MPI #79)
      - 2) Substitutions: Section 016000 Product Requirements.
  - 5. Stain Blocking Primer, Water Based; MPI #137.
    - a. Products:
      - 1) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #137)
      - Pratt & Lambert Pro-Hide Gold Interior/Exterior Waterborne Primer. (MPI #137)
      - 3) Rodda First Coat Interior Exterior Latex Primer, 501601. (MPI #137)
      - 4) Substitutions: Section 016000 Product Requirements.
  - 6. Latex Primer for Interior Wood; MPI #39.
    - a. Products:
      - 1) Kilz Premium Water-Based Primer [No. 1300].
      - 2) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #39)
      - Pratt & Lambert Pro-Hide Gold Interior/Exterior Waterborne Primer. (MPI #39)
      - 4) Rodda Unique II Primer, 502001. (MPI #39)
      - 5) Substitutions: Section 016000 Product Requirements.
  - 7. Bonding Primer, Water Based; MPI #17.
    - a. Products:
      - 1) Kilz Adhesion Bonding Primer [No. L2111].
      - 2) PPG Paints Seal Grip Acrylic Primer, 17-921 Series. (MPI #17)
      - 3) Pratt & Lambert Acrylic Waterborne Bonding Primer.
      - 4) Substitutions: Section 016000 Product Requirements.

#### 2.5 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

## PART 3 EXECUTION

## 3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
  - 1. Gypsum Wallboard: 12 percent.
  - 2. Plaster and Stucco: 12 percent.
  - 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
  - 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
  - 5. Concrete Floors and Traffic Surfaces: 8 percent.

## 3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- D. Seal surfaces that might cause bleed through or staining of topcoat.

#### E. Concrete:

- Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

#### F. Masonry:

1. Prepare surface as recommended by top coat manufacturer.

- G. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- I. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

## K. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

## L. Ferrous Metal:

- 1. Solvent clean according to SSPC-SP1.
- 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- M. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- N. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

## 3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- E. Sand wood and metal surfaces lightly between coats to achieve required finish.

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- F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

## 3.4 CLEANING

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

END OF SECTION 099123

# DIVISION 22 PLUMBING

#### SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

## A. Section Includes:

- 1. Sleeves.
- 2. Sleeve-seal systems.
- 3. Sleeve-seal fittings.
- 4. Grout.
- 5. Silicone sealants.

## B. Related Requirements:

1. Division 7 Section "Penetration Fire-stopping" for penetration fire-stopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

## PART 2 - PRODUCTS

## 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

- D. Galvanized-Steel-Sheet Sleeves for Penetrating Non-fire-Rated Gypsum Board Assemblies: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.

#### 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve:
  - 1. Sealing Elements: EPD or BunaN Rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, water-stop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber water-stop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications in non-fire-rated walls or floors.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

#### 2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

- 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- 2. Sealant shall have low VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

## PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION FOR PIPING

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls:
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed:
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces:
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeveseal system.
- D. Install sleeves for pipes passing through interior partitions:
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for fire-stopping specified in Division 7 Section "Penetration Fire-stopping."
- 3.2 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS
  - A. Comply with NECA 1.

- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

# 3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping or raceway entries into building.
- B. Select type, size, and number of sealing elements required for piping or raceway material and size for sleeve ID or size of hole. Position piping raceway in center of sleeve. Center piping cable in penetration, assemble sleeve-seal system components, and install in annular space between piping raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

# 3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
  - 2. Concrete Slabs above Grade:
    - a. Piping Smaller than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Stack-sleeve fittings.
  - 3. Interior Partitions:
    - a. Piping Smaller than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

**END OF SECTION 220517** 

# SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermo-wells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
  - 6. Test-plug kits.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

## 2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Palmer Wahl Instrumentation Group.
    - b. Trerice, H. O. Co.
    - c. Weiss Instruments, Inc.
    - d. Wekster Instruments Operating Unit: Dresser Industries, Instrument Div.

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- 2. Standard: ASME B40.200.
- 3. Case: Die Cast aluminum; 9-inch nominal size unless otherwise indicated.
- 4. Case Form: Adjustable angle type 180 degrees in vertical plane, 360 degrees in horizontal plane with locking device, unless otherwise indicated.
- 5. Tube: Glass with magnifying lens and red organic liquid.
- 6. Tube Background: Satin-faced non-reflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Window: Glass.
- 8. Stem Copper Plate Steel: Aluminum or brass for Thermo-well installation and of length to suit installation:
  - a. Design for Thermo-well Installation: Bare stem.
- 9. Connector: ASME B1.1 screw-threads to suit installation.
- 10. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

# 2.2 THERMO-WELLS

## A. Thermo-wells:

- 1. Standard: ASME B40.200.
- 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
- 3. Material for Use with Copper Tubing: CNR or CUNI.
- 4. Material for Use with Steel Piping: CRES or CSA.
- 5. Type: Stepped shank unless straight or tapered shank is indicated.
- 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
- 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw-threads.
- 8. Bore: Diameter required to match thermometer bulb or stem.
- 9. Insertion Length: Length required to match thermometer bulb or stem.
- 10. Lagging Extension: Include on thermo-wells for insulated piping and tubing sized to prevent interference with insulation.
- 11. Bushings: For converting size of thermo-well's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Trerice, H. O. Co.
    - b. Weiss Instruments, Inc.
    - c. Wekster Instruments Operating Unit: Dresser Industries, Instrument Div.
  - 2. Standard: ASME B40.100.
  - Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
  - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.

- 5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- 6. Movement: Mechanical, with link to pressure element and connection to pointer.
- 7. Dial: Satin-faced non-reflective aluminum with permanently etched scale markings graduated in psi.
- 8. Pointer: Red or other dark-colored metal.
- 9. Window: Glass or plastic.
- 10. Ring: Metal.
- 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- 12. Range for Fluids Under Pressure: Two times operating pressure.

## 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and corrosion-resistant porous-metal-type disc of material suitable for system fluid and working pressure. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

## 2.5 TEST PLUGS

- 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. Trerice, H. O. Co.
  - 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 3. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts, gasket and threaded cap. Include extended stem on units to be installed in insulated piping, sized to prevent interference with insulation.
- D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: EPDM self-sealing rubber.

# 2.6 TEST-PLUG KITS

- 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. Trerice, H. O. Co.

- 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
- 3. Weiss Instruments, Inc.
- B. Furnish one test-plug kit containing two thermometers, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with minimum 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. High-Range Thermometer: Small, bimetallic insertion type with minimum 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- E. Pressure Gage: Small, Bourdon-tube insertion type with minimum 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- F. Carrying Case: Metal or plastic, with formed instrument padding.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install thermo-wells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermo-wells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermo-wells with extension on insulated piping, sized to prevent interference with insulation.
- D. Fill thermo-wells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermo-wells with stems of length to match thermo-well insertion depth and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install needle valve and snubber in piping for each pressure gage for fluids (except steam).
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic zone.
  - 2. Inlet and outlet of each hydronic coil in air-handling units.

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- 3. Inlet and outlet of each domestic water heater or heat exchanger.
- 4. Suction and discharge of each pump.
- 5. Other locations as indicated on the drawings.
- J. Install pressure gages in the following locations:
  - 1. Inlet and outlet of each pressure-reducing valve.
  - 2. Inlet and outlet of each hydronic boiler.
  - 3. Building water service entrance.
  - 4. Suction and discharge of each pump, hydronic water.
  - 5. Other locations as indicated on the drawings.

## 3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

## 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

## 3.4 THERMOMETER SCHEDULE

- A. Thermometers shall be installed as indicated below:
  - 1. Liquid-in-glass type.

# 3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Hot Water Piping: 30 to 240 deg F (0 to 110 deg C) with 2-degree F (1-degree C) scale division.

## 3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. For fluids under pressure, provide pressure gages with range at two times the operating pressure. Contractor shall determine the actual operating pressure during system balancing and select pressure gauges to meet operational conditions.

## **END OF SECTION 220519**

# SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Ball valves.
  - 2. Butterfly valves.
  - 3. Swing check valves.

#### 1.3 SUBMITTALS

A. Product Data: For each type of valve indicated.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

## PART 2 - PRODUCTS

## 2.1 GENERAL REQUIREMENTS FOR VALVES

A. American made valves are preferred. Chinese manufactured valves will not be acceptable unless Contractor can show that no other source is available. Valves

manufactured in countries other than USA require review and acceptance by Engineer and Owner's representative.

- B. Refer to valve schedule articles for applications of valves.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
  - 3. Solder Joint: With sockets according to ASME B16.18.
  - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

#### 2.2 BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
  - 1. Description:
    - a. Standard: MSS SP-110 or MSS-145.
    - b. CWP Rating: 600 psig.
    - c. Body Design: Two piece.
    - d. Body Material: Bronze.
    - e. Ends: Threaded and soldered.
    - f. Seats: PTFE.
    - g. Stem: Bronze or brass.
    - h. Ball: Chrome-plated brass.
    - i. Port: Full.
    - j. Operator: Vinyl-covered extended steel lever handle.

## 2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM or NBR Seat and Epoxy Coated Ductile-Iron Disc:
  - 1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM or NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Epoxy coated ductile iron.

## 2.4 BRONZE SWING CHECK VALVES

- A. Check Valves (2" and less): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure. Check valve shall be equal Nibco T-413 for threaded ends or Nibco S-413 for solder ends
- B. Check Valves (2½" and larger): Check valve shall have cast iron body and cast-iron bolted bonnet the disc and seat ring shall be bronze. Check valve shall be horizontal swing with renewable seat and disc. Valve shall be rated for 200 psi working pressure. Check valve shall be equal to Nibco F-918 for flanged ends and Nibco T-918 for threaded ends. Threaded ends valve allowed for sizes 3" and less only. Victaulic 716/W716 are acceptable with grooved piping systems.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
  - 1. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 300 psig.
    - c. Body Design: Horizontal flow, Y-pattern.
    - d. Body Material: ASTM B 62, cast bronze and cap.
    - e. Ends: Threaded or soldered.
    - f. Disc: Bronze, with rubber or composition seat.

## 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.
- 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 check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

## 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

# 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or butterfly valves.
  - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  - 3. Throttling Service: Ball or butterfly valves.
  - 4. Pump Discharge: Swing Check Valves
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated.
  - 3. For Steel Piping, NPS 2 and Smaller: Threaded or grooved ends.
  - 4. For Steel Piping, NPS 2-1/2 and Larger: Flanged or grooved ends.

# 3.5 VALVE SCHEDULE

# A. Pipe NPS 2 and Smaller:

- 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- 2. Ball Valves: Two-piece, full port, bronze with bronze trim.
- 3. Bronze Swing Check Valves: Class 125, bronze disc.

## B. Pipe NPS 2-1/2 and Larger:

- 1. Iron Valves: May be provided with grooved, threaded or flanged ends.
- 2. Ball Valves: Class 150.
- 3. Iron, Single-Flange Butterfly Valves: 150 CWP, EPDM or NBR seat, epoxy coated, ductile-iron disc.
- 4. Iron, Grooved-End Butterfly Valves: 175 CWP.
- 5. Iron Swing Check Valves: Class 125 metal seats.

END OF SECTION 220523

## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 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 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing 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.

#### 1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 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: Pre-galvanized 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.

# B. Copper Pipe 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 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. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  - 2. Standard: MFMA-4.
  - 3. Channels: Continuous slotted steel channel with inturned 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 carbon steel.
  - 6. Metallic Coating: Electroplated zinc or Hot-dipped galvanized.
  - 7. Paint Coating: Vinyl alkyd.

# 2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

## 2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless-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.

## 2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

## 2.7 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, non-shrink and nonmetallic grout; suitable for interior and exterior applications:
  - 1. Properties: Non-staining, 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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- E. Install hangers and supports to allow controlled thermal 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.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. 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.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. 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.
- J. 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.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

## 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel support 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.

#### 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. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use copper-plated pipe hangers and copper attachments for uninsulated copper piping and tubing.
- E. Use thermal-hanger shield inserts for insulated piping and tubing.

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- 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. 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.
  - 3. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
  - 4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 5. 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.
  - 6. 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.
  - 7. 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.
  - 8. 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.
- 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. 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.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  - 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams
  - 4. C-Clamps (MSS Type 23): For structural shapes.

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- 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 7. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 8. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
- 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 10. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

**END OF SECTION 220529** 

#### SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 COORDINATION

- 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.
- D. Identification of Equipment in Concealed Space: All equipment and valves concealed in ceiling space shall be identified in this manner: Use a professional labeling machine and ½ inch clear tape with black type. Place the label of the equipment on the grid of the ceiling tile directly under the equipment housed above.

## PART 2 - PRODUCTS

## 2.1 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact type, permanent adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, 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 1-1/2 inches high.

## 2.2 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers:
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass beaded chain or nylon ziptie.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses:
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Clean piping surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- B. All concealed valves shall be identified. Using professional labeling machine and ½ inch tape identification on the ceiling grid shall be black letters on clear tape directly under the valves

## 3.2 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.

- 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
- 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Pipe Label Color Schedule Coordinate color scheme with Owner's standard or preference. If the Owner does not have a standard or preference, use ANSI/ASME Standards.

## 3.3 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawnwatering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. All Applications: 1-1/2 inches, round.
  - 2. Valve-Tag Color:
    - a. All Applications: Natural brass with black letters/numbers.
  - 3. Letter Color:
    - a. All Applications: Black.

**END OF SECTION 220553** 

#### SECTION 220719 - PIPING INSULATION

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section includes insulating the following piping services. Contractor shall field verify the extent of damaged/missing equipment insulation prior to bidding and request clarification for extend of work during bidding or if not requested, then include all costs associated with repair/replace all damaged/missing insulation on the following systems:
  - 1. Condensate drain piping.
  - 2. Domestic water piping.

# 1.3 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. 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.

# 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.

#### 1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22.
- 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.

#### 1.6 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.

## PART 2 - PRODUCTS

## 2.1 INSULATION MATERIALS

- A. Comply with requirements in other sections of specifications and drawing notes.
- B. Glass Fiber: Wherever fiberglass is permitted to be used, it shall be like Johns Manville Micro-Lok AP-T meeting ASTM C547; Type I, rigid molded, noncombustible.
  - 1. "K" ("ksi") Value: 0.23 at 75°F mean temperature and .24 at 100°F mean temperature as tested per ASTM C335.
  - 2. Maximum Service Temperature: 850 degrees F.
  - Vapor Retardant Jacket: AP-T PLUS White Kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples coated with vapor barrier mastic as needed.
  - 4. Fiberglass pipe insulation shall be factory molded tubular fiberglass with "all service" jacket having an integral barrier. Longitudinal joints of the jacket shall be overlapping with factory applied adhesive. Staples on 6" centers may be used with vapor barrier mastic applied to seal both the joint and staple holes. Butt joints shall be sealed with 3"-wide ASJ pressure sensitive tape.
  - 5. Products: Subject to compliance with requirements, provide products by one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200
    - b. Johns Manville; Micro-Lok
    - c. Knauf fiberglass: 1000 Pipe Insulation
    - d. Mason Insulation Inc.; Alley-K
    - e. Owens Corning; Fiberglass Pipe Insulation

- 6. Insulation shall be high density.
- 7. Submit sample.
- C. Flexible Elastomeric Insulation for Piping Systems Operating at 220° F or Below: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
  - 2. Thermal Conductivity Through 1 Inch: 0.25 BTU-in/h-ft2-°F at 75°F mean temperature and 0.256 BTU-in/h-ft2-°F at 90° F mean temperature as tested per ASTM C177 or C518.
  - 3. Thermal Conductivity 1-1/2 Inches and 2 Inches: 0.28 BTU-in/h-ft2-°F at 75°F mean temperature and 0.286 BTU-in/h-ft2-°F at 90°F mean temperature as tested per ASTM E96, Procedure A.
  - 4. Water Vapor Permeability: 0.05 Perm-in as tested per ASTM E96, Procedure A.
  - 5. Flame Spread and Smoke Developed Index: 25/50 (1" thick and below).
  - 6. Maximum Continuous Service Temperature: 220° F
  - 7. Connections: Waterproof vapor retarder adhesive as needed for end connections and seams; self-sealing longitudinal seams are acceptable.
  - 8. UV Protection: Where exposed to outdoors, provide UV protective coatings.
  - 9. Colors: Where concealed or not visible provide manufacturer's standard or black; where exposed to view provide insulation with white finish.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Ramco Insulation, Inc.; Super-Stik.

## 2.3 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. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. Armacell LLC; Armaflex 520 Adhesive.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> Company; 85-75.
    - d. K-Flex USA; R-373 Contact Adhesive.

- 2. 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. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.</u>
    - b. Eagle Bridges Marathon Industries; 225.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.</u>
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. 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).

### 2.4 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. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> Company; 30-80/30-90.
    - b. Vimasco Corporation: 749.
  - 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.

#### 2.5 SEALANTS

- A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.</u>
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.

- 5. Color: White.
- 6. 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).

## 2.6 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: One piece molded type, high-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Johns Manville; Zeston, 2000.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: White.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

# 2.7 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following

- a. ABI, Ideal Tape Division; 491 AWF FSK.
- b. <u>Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.</u>
- c. Compac Corporation; 110 and 111.
- d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
- 2. Width: 3 inches.
- 3. Thickness: 6.5 mils.
- 4. Adhesion: 90 ounces force/inch in width.
- 5. Elongation: 2 percent.
- 6. Tensile Strength: 40 lbf/inch in width.
- 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing EPA approved anti-microbial additive.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armacell LLC; AP/Armaflex Insulation Tape
  - 2. Width: 2 inches
  - 3. Thickness: 1/8 inch.

#### 2.8 SECUREMENTS

### A. Bands:

- 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
- 2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick 3/4 inch wide with closed seal.

## 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.
- 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 degrees F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

## 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Piping systems shall be insulated as described below. Pipe, fittings, unions, flanges, mechanical joint couplings, valves, devices, specialties and related items in the piping system shall be insulated unless otherwise excepted.
- B. Mechanical joint fittings and couplings shall be considered as part of the pipe line and shall be insulated. Bidders on the insulation work are cautioned to verify during the bidding period the extent of this work.
- C. 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.
- D. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- E. 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.
- F. Install insulation with longitudinal seams at bottom of horizontal runs.
- G. Install multiple layers of insulation with longitudinal and end seams staggered.
- H. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- I. Keep insulation materials dry during application and finishing.
- J. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- K. Install insulation with least number of joints practical.
- L. 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 compatible with insulation material.

- 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.
- M. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. 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.
- Q. 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. 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 Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

# 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, 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.
- 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. 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.

#### 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 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 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.
  - 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.
  - 5. All insulation shall be white in color where not concealed.

## 3.7 INSTALLATION OF FIBERGLASS 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 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.
- C. 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. Exposed piping throughout the facility, including outdoors, shall receive field-applied jacketing over insulation as follows:
  - 1. For pipe exposed in the mechanical equipment rooms or in finished spaces below 10 feet above finished floor, finish with Zeston 2000 PVC jacket and fitting covers.
  - 2. PVC Plastic: Zeston 2000 or equal. One piece molded type fitting covers and jacketing material, gloss white. Connections are permaweld adhesive; tacks or pressure sensitive color matching vinyl tape. Zeston 2000 shall have flame spread rating of 25 or less and a smoke developed rating of 50 or less.

## 3.9 FINISHES

- A. Exposed pipe insulation in finished spaces with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
  - 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. Colors to be selected by Owner.
- B. Color: Where exposed to view color shall be white. Vary first and second coats to allow visual inspection of the completed Work.

#### 3.10 PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be one of the following:

- a. Fiberglass: 1/2 inch thick.
- b. Flexible Elastomeric: 1/2 inch thick.

## B. Domestic Cold Water:

- 1. NPS 1 and Smaller: Insulation shall be one of the following:
  - a. Fiberglass: 1 inch thick.
  - b. Flexible Elastomeric: 1 inch thick.
- 2. NPS 1-1/2and Larger: Insulation shall be one of the following:
  - a. Fiberglass: 1 inch thick.
  - b. Flexible Elastomeric: 1 inch thick.
- C. Domestic Hot, Tempered, and Recirculated Hot Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
    - a. Fiberglass: 1 inch thick.
    - b. Flexible Elastomeric: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
    - a. Fiberglass: 1-1/2 inches thick.
    - b. Flexible Elastomeric: 1-1/2 inches thick.

**END OF SECTION 220719** 

#### SECTION 221116 - DOMESTIC WATER PIPING

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

#### 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. Plastic piping components shall be marked with "NSF-pw."
- C. Piping materials shall bear label, stamp or other markings of specified testing agency.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Hard Copper tube: ASTM B 88, Type K water tube, drawn temper.
- C. Copper Pressure-Seal-Joint 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:
    - a. Elkhart Products Corporation.
    - b. NIBCO Inc.
    - c. Viega.
  - 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- D. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

E. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

# 2.3 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.

## 2.4 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: 125 psig minimum at 180 deg F.
- C. Dielectric Flanges:
  - 1. Standard: ASSE 1079.
  - 2. Factory-fabricated, bolted, companion-flange assembly.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F.
- D. Dielectric-Flange Insulating Kits:
  - 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.
- E. Dielectric Nipples:
  - 1. Standard: IAPMO PS 66.
  - 2. Electroplated steel nipple complying with ASTM F 1545.
  - 3. Pressure Rating and Temperature: 300 psig at 225 deg F.
  - 4. End Connections: Male threaded or grooved.
  - 5. Lining: Inert and noncorrosive, propylene.

#### PART 3 - EXECUTION

## 3.1 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 shutoff valve immediately upstream of each dielectric fitting.
- C. Install domestic water piping level without pitch and plumb.
- D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- E. Install all piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- G. Install piping to permit valve servicing.
- H. 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.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- L. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for MEP/FP Piping, Raceways and Cabling."
- M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Piping."

#### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

- C. 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.
- D. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- E. Extruded-Tee Connections: Are not permitted.
- F. 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."
- G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- H. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

## 3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

#### 3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

#### 3.5 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 or unions.

#### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
  - 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.
  - 3. 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.
- 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.

### 3.7 CONNECTIONS

- A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified. If Drawings are explicit enough, these requirements may be reduced or omitted.
- B. Drawings indicate general arrangement of piping, fittings, and specialties.
- C. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- D. Connect new domestic water piping to existing water piping with shutoff valve; extend and connect to water heaters, expansion tank, etc. as indicated on drawings.

#### 3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for HVAC and Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

#### 3.9 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.

#### 3.10 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.11 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. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.12 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. All aboveground domestic water piping shall be one of the following (unless otherwise indicated):
  - 1. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
  - 2. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
- D. Under-building slab, domestic water, building-service piping specified shall be one of the following (unless otherwise indicated).

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- 1. Hard copper tube, ASTM B88, Type K; copper pressure-seal-joint fittings; and pressure-sealed joints.
- 2. Hard copper tube, ASTM B 88, Type K; cast-or wrought-copper, solder-joint fittings; and soldered joints.

## 3.13 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 2 and smaller.
  - 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Hot-Water Circulation Piping, Balancing Duty: Memory-stop balancing valves.
  - 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 221116** 

#### SECTION 221119 - 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 other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Strainers.
  - 2. Drain valves.
  - 3. Wall hydrants.
  - 4. Trap primer systems.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties. Include diagrams for power, signal, and control wiring.
- C. Field quality-control test reports.
- D. 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, "Drinking Water System Components – Health Effects" Sections 1-9.

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.

## 2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

#### 2.3 STRAINERS FOR DOMESTIC WATER PIPING

#### A. Y-Pattern Strainers:

- 1. Pressure Rating: 125 psig minimum unless otherwise indicated.
- 2. Body: Bronze for NPS 2 and smaller.
- 3. End Connections: Threaded for NPS 2 and smaller.
- 4. Screen: Stainless steel with round perforations unless otherwise indicated.
- Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
- 6. Drain: Factory-installed, hose-end drain valve with cap and chain.

#### 2.4 DRAIN VALVES

- A. Ball-Valve-Type, Hose-End Drain Valves:
  - 1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
  - 2. Pressure Rating: 400-psig minimum CWP.
  - 3. Size: NPS 3/4.
  - 4. Body: Copper alloy.
  - 5. Ball: Chrome-plated brass.
  - 6. Seats and Seals: Replaceable.
  - 7. Handle: Vinyl-covered steel.
  - 8. Inlet: Threaded or solder joint.
  - 9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

# 2.5 WALL HYDRANTS

- A. Nonfreeze, Cold-Water Wall Hydrants HYD-1:
  - 1. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
  - 2. Pressure Rating: 125 psig.
  - Operation: Loose key.
  - 4. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
  - 5. Inlet: NPS 3/4 or NPS 1.
  - Outlet: Concealed.

- 7. Box: Deep, flush mounted with cover.
- 8. Box and Cover Finish: Chrome plated.
- 9. Vacuum Breaker:
  - Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
  - b. Garden-hose thread complying with ASME B1.20.7 on outlet.
- 10. Operating Key(s): Two with each wall hydrant.

#### 2.6 TRAP-SEAL PRIMER SYSTEMS

- A. Trap-Seal Primer Systems ETP-1:
  - 1. Standard: ASSE 1044.
  - 2. Inlet Size: NPS 1/2, ASTM B88, Type L; copper, water tubing.
  - 3. Cabinet: Surface-mounted steel box with stainless steel cover.
  - 4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.
    - 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.
  - 5. Vacuum Breaker: ASSE 1001.
  - 6. Number Outlets: 1.
  - 7. Size Outlets: NPS 1/2.

## PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- B. Install air vents at high points of water piping. Install drain piping and discharge into floor drain.
- C. Wall Hydrants: Install in masonry wall.
- D. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

## 3.2 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

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END OF SECTION 221119

## SECTION 221316 - SANITARY WASTE AND VENT PIPING

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 RELATED DOCUMENTS

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

### 1.3 SUMMARY

- A. Section Includes:
  - 1. PVC pipe and fittings.
  - 2. Specialty pipe fittings.
- B. Related Requirements:
  - 1. Section 221319 "Sanitary Waste Piping Specialties".

#### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

#### 1.5 WARRANTY

A. Manufacturers to provide labeling and warranty of their respective products.

#### PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Sanitary Waste, and Vent Piping: 10-foot head of water.

## 2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

### 2.3 PVC PIPE AND FITTINGS

- A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-DWV" for plastic drain, waste, and vent piping.
- B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.
- D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- E. Adhesive Primer: ASTM F 656.
- F. Solvent Cement: ASTM D 2564.

#### 2.4 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

## PART 3 - EXECUTION

## 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems:
  - 1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.

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- 2. 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 adequate space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends:
  - 1. 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.
  - 2. 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 drainpipe:
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected:
    - a. Reducing size of waste piping in direction of flow is prohibited.
- I. Lay buried building waste piping beginning at low point of each system:
  - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 3. Maintain swab in piping and pull past each joint as completed.
- J. Install sanitary waste and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Waste: 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. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- K. Install aboveground PVC piping according to ASTM D 2665.
- L. Install underground PVC piping according to ASTM D 2321.

# M. Plumbing Specialties:

- 1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping:
  - a. Install cleanout fitting with closure plug inside the building in sanitary drainage piping.
- 2. Install drains in sanitary waste gravity-flow piping:
  - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- O. Install sleeve seals for piping penetrations of concrete walls and slabs:

## 3.2 JOINT CONSTRUCTION

- A. Plastic, Non-pressure Piping, Solvent-Cement 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 Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

#### 3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  - 1. Install non-pressure transition couplings at joints of piping with small differences in ODs.

#### 3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

#### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste 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 waste 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.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

#### 3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

#### 3.7 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. Test sanitary waste 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:
    - a. 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 waste and vent piping until it has been tested and approved:
    - a. Expose work that was covered or concealed before it was tested.
  - 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in:
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. 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:
    - a. 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.

- b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
- c. Air pressure must remain constant without introducing additional air throughout period of inspection.
- d. 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.

## 3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping 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.
- E. Repair damage to adjacent materials caused by waste and vent piping installation.

#### 3.9 PIPING SCHEDULE

- A. Above, and below ground sanitary waste and vent piping shall be the following:
  - 1. Schedule 40 PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2. Dissimilar Pipe-Material Couplings: non-pressure transition couplings.

**END OF SECTION 221316** 

#### SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

#### 1.3 COORDINATION

A. Coordinate size and location of roof penetrations.

#### PART 2 - PRODUCTS

## 2.1 CLEANOUTS

- A. Metal Floor Cleanouts:
  - 1. ASME A112.36.2M, Cast-Iron Cleanouts.
  - 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
  - 3. Size: Same as connected branch.
  - 4. Type: Threaded, adjustable housing.
  - 5. Body or Ferrule: Cast iron.
  - 6. Clamping Device: Required.
  - 7. Outlet Connection: Inside caulk.
  - 8. Closure: Brass plug with straight threads and gasket.
  - 9. Adjustable Housing Material: Cast iron with threads.
  - 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy with tamper-resistant/vandal-proof screws.

- 11. Frame and Cover Shape: Round.
- 12. Top Loading Classification: Heavy Duty.

#### 2.2 FLOOR DRAINS

#### A. Cast-Iron Floor Drains:

- 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. Zurn Plumbing Products Group
  - b. Josam Company
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe; Wade Div.
- 2. Standard: ASME A112.6.3.
- 3. Pattern: Floor and sanitary drain.
- 4. Body Material: Gray iron.
- 5. Seepage Flange: Required.
- 6. Anchor Flange: Required.
- 7. Clamping Device: Required.
- 8. Outlet: Bottom.
- 9. Sediment Bucket: As indicated on Drawings.
- 10. Top or Strainer Material: Nickel bronze with tamper-resistant/vandal-proof screws.
- 11. Top of Body and Strainer Finish: Nickel bronze.
- 12. Top Shape: Round.
- 13. Top Loading Classification: Heavy Duty.
- 14. Funnel: As indicated on Drawings.
- 15. Trap Material: As indicated on Drawings.
- 16. Trap Pattern: As indicated on Drawings.
- 17. Trap Features: Cleanout and trap-seal primer valve drain connection.

### 2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

# A. Open Drains:

- 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
- 2. Size: Same as connected waste piping with increaser fitting of size indicated.

## B. Air-Gap Fittings:

- 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
- 2. Body: Bronze or cast iron.
- 3. Inlet: Opening in top of body.
- 4. Outlet: Larger than inlet.
- 5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

# C. Vent Caps:

- 1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
- 2. Size: Same as connected stack vent or vent stack.

### 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.
  - 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate at base of each vertical sanitary waste and rainwater stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated:
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- D. Install through-penetration firestop assemblies in plastic conductors at floor penetrations.
- E. Assemble open drain fittings and install with top of hub 2 inches above floor.
- 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.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

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- I. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- J. Install vent caps on each vent pipe passing through roof.

# 3.2 CONNECTIONS

- A. Comply with requirements in Division 22 Section "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

## 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system 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.

### 3.4 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 221319** 

#### SECTION 221414 - STORM DRAINAGE PIPING

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Hubless, cast-iron soil pipe and fittings.
  - 2. PVC pipe and fittings.

# 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. Hubless, cast-iron soil pipe and fittings.

# 1.4 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: Inspection reports signed by authorities having jurisdiction (where applicable).

#### 1.5 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

### 1.6 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products

#### PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:
  - 1. Storm Drainage Piping: 10-foot head of water .

## 2.2 PIPING MATERIALS

- A. Piping materials to bear label, stamp, or other markings of specified testing agency.
- B. 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.

# 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS (ABOVE GROUND)

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - 1. AB & I Foundry; a part of the McWane family of companies.
  - 2. Charlotte Pipe and Foundry Company.
  - 3. Tyler Pipe; a part of McWane family of companies.

## B. Pipe and Fittings:

- 1. Marked with CISPI collective trademark and NSF certification mark.
- 2. Standards: ASTM A888 and CISPI 301.
- C. Standard, Hubless-Piping Couplings:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe and Foundry Company.
    - b. Fernco Inc.
    - c. MIFAB. Inc.
  - 2. Marked with CISPI collective trademark and NSF certification mark.
  - 3. Standards: ASTM C1277 and CISPI 310.
  - 4. Description: Stainless steel corrugated shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
- D. Heavy-Duty, Hubless-Piping Couplings:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Charlotte Pipe and Foundry Company.

- b. Fernco Inc.
- c. MIFAB, Inc.
- 2. Standard: ASTM C1277 or ASTM C1540.
- 3. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.

# E. Cast-Iron, Hubless-Piping Couplings:

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
  - a. MG Piping Products Company.
  - b. Charlotte Pipe and Foundry Company
  - c. Fernco Inc.
- 2. Standard: ASTM A1056.
- 3. Description: Two-piece ASTM A48/A48M, cast-iron housing; stainless steel bolts and nuts; and ASTM C564, rubber sleeve with integral, center pipe stop.

## 2.4 PVC PIPE AND FITTINGS

# A. PVC Pipe:

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - a. Charlotte Pipe and Foundry Company.
  - b. JM Eagle.
  - c. National Pipe and Plastic, Inc.
  - d. North America Pipe Corporation.
- 2. NSF Marking: Comply with NSF 14 for plastic piping components. Include marking with "NSF-dwv" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- 3. Solid-Wall PVC Pipe: ASTM D2665 drain, waste, and vent.
- 4. Cellular-Core PVC Pipe: ASTM F891, Schedule 40.

# B. PVC Socket Fittings:

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
  - a. Charlotte Pipe and Foundry Company.
  - b. NIBCO INC.
  - c. North America Pipe Corporation.
- 2. Standard: ASTM D2665, made in accordance with ASTM D3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- 3. NSF Marking: Comply with NSF 14 for plastic piping components. Include marking with "NSF-dwv" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.
- C. Adhesive Primer: ASTM F656.
- D. Solvent Cement: ASTM D2564.

#### PART 3 - EXECUTION

### 3.1 INSTALLATION OF PIPING

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
- B. Install piping as indicated unless deviations from layout are approved on coordination drawings.
- C. Install piping in concealed locations.
  - 1. Piping installed in equipment rooms, service areas, and where indicated may be exposed.
- 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.
  - 1. Do not change direction of flow more than 90 degrees.
  - 2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of drainage piping in direction of flow is prohibited.
- L. Lay buried building piping beginning at low point of each system.
  - 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
  - 2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 3. Maintain swab in piping and pull past each joint as completed.
- M. Install piping at the following minimum slopes unless otherwise indicated.

- 1. Building Storm Drain: 1/4 inch per foot downward in direction of flow for piping NPS 3 and smaller; 1/8 inch per foot downward in direction of flow for piping NPS 4 and larger.
- 2. Horizontal Storm Drainage Piping: 1/4 inch per foot downward in direction of flow.
- N. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Ch IV, "Installation of Cast Iron Soil Pipe and Fittings."
- O. Install underground PVC piping in accordance with ASTM D2321.
- P. Install engineered controlled-flow drain specialties and storm drainage piping in locations indicated.
- Q. Plumbing Specialties:
  - 1. Install cleanouts in storm drainage gravity-flow piping in accessible locations.
    - a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
    - b. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
  - 2. Install drains in storm drainage gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."
- R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- S. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

# 3.2 JOINT CONSTRUCTION

- A. Hubless, Cast-Iron Soil Piping Coupled Joints: Join in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:
  - 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Piping: Join in accordance with ASTM D2855 and ASTM D2665 appendices.

# C. Joint Restraints and Sway Bracing:

- 1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with the following conditions:
  - a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
  - b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
  - c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

# 3.3 INSTALLATION OF SPECIALTY PIPE FITTINGS

# A. Transition Couplings:

- 1. Install transition couplings at joints of piping with small differences in ODs.
- 2. In Drainage Piping: Shielded, nonpressure transition couplings.

# B. Dielectric Fittings:

- 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- 2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples.
- 3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples.
- 4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

## 3.4 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install stainless steel pipe hangers for horizontal piping.
  - 2. Install stainless steel pipe support clamps for vertical piping.
  - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 4. 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.
  - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
- C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical PVC piping with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

#### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect storm drainage piping to roof drains and storm drainage specialties.
  - 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

## 3.6 IDENTIFICATION

- A. Identify exposed storm drainage piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

## 3.7 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.
  - 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 storm drainage piping in accordance with 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.
    - a. 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 storm drainage piping until it has been tested and approved.

- a. Expose work that was covered or concealed before it was tested.
- 3. Test Procedure:
  - a. Test storm drainage piping , except outside leaders, on completion of roughing-in.
  - b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
  - c. From 15 minutes before inspection starts until completion of inspection, water level must not drop.
  - d. Inspect joints for leaks.
- 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- 5. Prepare reports for tests and required corrective action.

# 3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

## 3.9 PROTECTION

- A. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day and when work stops.
- C. Repair damage to adjacent materials caused by storm drainage piping installation.

# 3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground storm drainage piping NPS 6 and smaller is to be the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI, hubless-piping couplings; and coupled joints.
- C. Underground storm drainage piping NPS 6 and smaller is to be the following:
  - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

## SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

## PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 RELATED DOCUMENTS

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

## 1.3 SUMMARY

- A. Section Includes:
  - 1. Roof drains.
  - 2. Miscellaneous storm drainage piping specialties.
  - 3. Cleanouts.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

# 1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

## PART 2 - PRODUCTS

# 2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Specification Drainage Operation; Z163, or comparable product by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe, Wade Div.
  - e. Watts Water Technologies, Inc.
- 2. Standard: ASME A112.6.4, for general-purpose roof drains.
- 3. Body Material: Cast iron .
- 4. Dimension of Body: Nominal 15" diameter.
- 5. Combination Flashing Ring and Gravel Stop: . Required.
- 6. Flow-Control Weirs: Required.
- 7. Outlet: Bottom Side .
- 8. Extension Collars: Required.
- 9. Underdeck Clamp: Required.
- 10. Expansion Joint: Required.
- 11. Sump Receiver Plate: Required.
- 12. Dome Material: Aluminum.
- 13. Perforated Gravel Guard: Not required.
- 14. Vandal-Proof Dome: Not required .
- 15. Water Dam for Secondary Drains: 2 inches high.

## 2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

# A. Conductor Nozzles:

- 1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
- 2. Size: Same as connected conductor.

# 2.3 CLEANOUTS

## A. Floor Cleanouts:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Zurn Plumbing Products Group; Light Commercial Products Operation; Z1400-BZ Z1400-K Z1402 or comparable product by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe.
  - e. Watts Water Technologies, Inc.
- 2. Standard: ASME A112.36.2M, for adjustable housing cast-iron soil pipe with cast-iron ferrule threaded, adjustable housing cleanouts.
- 3. Size: Same as connected branch.
- 4. Type: Threaded, adjustable housing.
- 5. Body or Ferrule Material: Cast iron .
- Clamping Device: Not required .

- 7. Outlet Connection: Threaded.
- 8. Closure: Cast-iron plug.
- 9. Adjustable Housing Material: Cast iron with threads .
- 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy .
- 11. Frame and Cover Shape: Round.
- 12. Top-Loading Classification: Medium Duty.
- 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

#### PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.
  - 1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
  - 2. Install expansion joints, if indicated, in roof drain outlets.
  - 3. Position roof drains for easy access and maintenance.
- B. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.
- C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:
  - 1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  - 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
  - 3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  - 4. Locate cleanouts at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- F. Install test tees in vertical conductors and near floor.
- G. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.
- H. Install through-penetration firestop assemblies in plastic conductors at concrete floor penetrations.
- I. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

## 3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

## 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 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 the pipe size, with a minimum length of 10 inches and with 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. Fabricate and install flashing and pans, sumps, and other drainage shapes.

# 3.4 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.

# 23 **DINISION**

#### SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 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 alternating-current 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: Premium 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: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- G. Temperature Rise: Match insulation rating.
- H. Insulation: Class F 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.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

# 2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

- 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. 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: Pre-lubricated, 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 (Not Applicable)

#### SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

## A. Section Includes:

- 1. Sleeves.
- 2. Sleeve-seal systems.
- 3. Sleeve-seal fittings.
- 4. Grout.
- 5. Silicone sealants.

# B. Related Requirements:

1. Division 7 Section "Penetration Fire-stopping" for penetration fire-stopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

## PART 2 - PRODUCTS

# 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

- D. Galvanized-Steel-Sheet Sleeves for Penetrating Non-fire-Rated Gypsum Board Assemblies: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

# 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve:
  - 1. Sealing Elements: EPD or BunaN Rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

# 2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, water-stop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber water-stop collar with center opening to match piping OD.

# 2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications in non-fire-rated walls or floors.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  - 2. Sealant shall have low VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.

# PART 3 - EXECUTION

## 3.1 SLEEVE INSTALLATION FOR PIPING

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls:
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed:
  - Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces:
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeveseal system.
- D. Install sleeves for pipes passing through interior partitions:
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for fire-stopping specified in Division 7 Section "Penetration Fire-stopping."

# 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping or material and size for sleeve ID or size of hole. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

## 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
  - 2. Concrete Slabs above Grade:
    - a. Piping Smaller than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Stack-sleeve fittings.
  - 3. Interior Partitions:
    - a. Piping Smaller than NPS 6: Galvanized-steel-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

## SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

## PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

# 1.3 SUBMITTALS

A. None required.

# PART 2 - PRODUCTS

# 2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

#### 2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

## PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening:
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or stamped-steel type with polished, chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or stamped-steel type with polished, chrome-plated or rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening:
  - 1. New Piping: One-piece, floor-plate type.

# 3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

# SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

## A. Section Includes:

- 1. Liquid-in-glass thermometers.
- 2. Thermo-wells.
- 3. Dial-type pressure gages.
- 4. Gage attachments.
- 5. Test plugs.
- 6. Test-plug kits.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

# PART 2 - PRODUCTS

# 2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Palmer Wahl Instrumentation Group.
    - b. Trerice, H. O. Co.
    - c. Weiss Instruments, Inc.
    - d. Wekster Instruments Operating Unit: Dresser Industries, Instrument Div.

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

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- 2. Standard: ASME B40.200.
- 3. Case: Die Cast aluminum; 9-inch nominal size unless otherwise indicated.
- 4. Case Form: Adjustable angle type 180 degrees in vertical plane, 360 degrees in horizontal plane with locking device, unless otherwise indicated.
- 5. Tube: Glass with magnifying lens and red organic liquid.
- 6. Tube Background: Satin-faced non-reflective aluminum with permanently etched scale markings graduated in deg F and deg C.
- 7. Window: Glass.
- 8. Stem Copper Plate Steel: Aluminum or brass for Thermo-well installation and of length to suit installation:
- 9. Design for Thermo-well Installation: Bare stem.
- 10. Connector: ASME B1.1 screw-threads to suit installation.
- 11. Accuracy: Plus, or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

# 2.2 THERMO-WELLS

## A. Thermo-wells:

- 1. Standard: ASME B40.200.
- 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
- 3. Material for Use with Copper Tubing: CNR or CUNI.
- 4. Material for Use with Steel Piping: CRES or CSA.
- 5. Type: Stepped shank unless straight or tapered shank is indicated.
- 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
- 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw-threads.
- 8. Bore: Diameter required to match thermometer bulb or stem.
- 9. Insertion Length: Length required to match thermometer bulb or stem.
- 10. Lagging Extension: Include on thermo-wells for insulated piping and tubing sized to prevent interference with insulation.
- 11. Bushings: For converting size of thermo-well's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

# 2.3 PRESSURE GAGES

- A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 2. Trerice, H. O. Co.
  - 3. Weiss Instruments, Inc.
  - 4. Wekster Instruments Operating Unit: Dresser Industries, Instrument Div.
- B. Standard: ASME B40.100.
- C. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

- D. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- E. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- F. Movement: Mechanical, with link to pressure element and connection to pointer.
- G. Dial: Satin-faced non-reflective aluminum with permanently etched scale markings graduated in psi.
- H. Pointer: Red or other dark-colored metal.
- I. Window: Glass or plastic.
- J. Ring: Metal.
- K. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- L. Range for Fluids Under Pressure: Two times operating pressure.

## 2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and corrosion-resistant porous-metal-type disc of material suitable for system fluid and working pressure. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4, ASME B1.20.1 pipe threads.

# 2.5 TEST PLUGS

- 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. Trerice, H. O. Co.
  - 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 3. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts, gasket and threaded cap. Include extended stem on units to be installed in insulated piping, sized to prevent interference with insulation.
- D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: EPDM self-sealing rubber.

## 2.6 TEST-PLUG KITS

- 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. Trerice, H. O. Co.
  - 2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - 3. Weiss Instruments, Inc.
- B. Furnish one test-plug kit containing two thermometers, one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with minimum 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. High-Range Thermometer: Small, bimetallic insertion type with minimum 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- E. Pressure Gage: Small, Bourdon-tube insertion type with minimum 3-inch-diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- F. Carrying Case: Metal or plastic, with formed instrument padding.

## PART 3 - EXECUTION

# 3.1 INSTALLATION

- A. Install thermo-wells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermo-wells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermo-wells with extension on insulated piping, sized to prevent interference with insulation.
- D. Fill thermo-wells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermo-wells with stems of length to match thermo-well insertion depth and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install needle valve and snubber in piping for each pressure gage for fluids (except steam).

- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
  - 1. Inlet and outlet of each hydronic zone.
  - 2. Inlet and outlet of each hydronic coil in air-handling units.
  - 3. Inlet and outlet of each domestic water heater or heat exchanger.
  - 4. Outlet of each domestic hot water mixing valve assembly.
  - 5. Suction and discharge of each pump.
  - 6. Other locations as indicated on the drawings.
- J. Install pressure gages in the following locations:
  - 1. Inlet and outlet of each pressure-reducing valve.
  - 2. Inlet and outlet of each hydronic boiler and domestic water heater.
  - 3. Building water service entrance.
  - 4. Suction and discharge of each pump, hydronic and domestic water.
  - 5. Other locations as indicated on the drawings.

# 3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

## 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

# 3.4 THERMOMETER SCHEDULE

- A. Thermometers shall be installed as indicated below:
  - 1. Liquid-in-glass type.

## 3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F (0 to 115 deg C) with 2-degree F (1-degree C) scale division.

# 3.6 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. For fluids under pressure, provide pressure gages with range at two times the operating pressure. Contractor shall determine the actual operating pressure during system balancing and select pressure gauges to meet operational conditions.

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## SECTION 230523 - GENERAL DUTY VALVES

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Ball valves.
  - 2. Butterfly valves.
  - 3. Swing check valves.

#### 1.3 SUBMITTALS

A. Product Data: For each type of valve indicated.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

## PART 2 - PRODUCTS

# 2.1 GENERAL REQUIREMENTS FOR VALVES

A. American made valves are preferred. Chinese manufactured valves will not be acceptable unless Contractor can show that no other source is available. Valves

SECTION 230523 - GENERAL DUTY

manufactured in countries other than USA require review and acceptance by Engineer and Owner's representative.

- B. Refer to valve schedule articles for applications of valves.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream piping unless otherwise indicated.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
  - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
  - 3. Solder Joint: With sockets according to ASME B16.18.
  - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

#### 2.2 BALL VALVES

- A. Bronze Ball Valves, Two-Piece with Full Port, and Bronze or Brass Trim, Threaded or Soldered Ends:
  - 1. Description:
    - a. Standard: MSS SP-110 or MSS-145.
    - b. CWP Rating: 600 psig.
    - c. Body Design: Two piece.
    - d. Body Material: Bronze.
    - e. Ends: Threaded and soldered.
    - f. Seats: PTFE.
    - g. Stem: Bronze or brass.
    - h. Ball: Chrome-plated brass.
    - i. Port: Full.
    - j. Operator: Vinyl-covered extended steel lever handle.

# 2.3 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 150 CWP, Iron, Single-Flange Butterfly Valves with EPDM or NBR Seat and Epoxy Coated Ductile-Iron Disc:
  - 1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM or NBR.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Epoxy coated ductile iron.

## 2.4 BRONZE SWING CHECK VALVES

- A. Check Valves (2" and less): Check valve shall have bronze body, disc and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure. Check valve shall be equal Nibco T-413 for threaded ends or Nibco S-413 for solder ends
- B. Check Valves (2½" and larger): Check valve shall have cast iron body and cast-iron bolted bonnet the disc and seat ring shall be bronze. Check valve shall be horizontal swing with renewable seat and disc. Valve shall be rated for 200 psi working pressure. Check valve shall be equal to Nibco F-918 for flanged ends and Nibco T-918 for threaded ends. Threaded ends valve allowed for sizes 3" and less only. Victaulic 716/W716 are acceptable with grooved piping systems.
- C. Class 150, Bronze Swing Check Valves with Bronze Disc:
  - 1. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 300 psig.
    - c. Body Design: Horizontal flow, Y-pattern.
    - d. Body Material: ASTM B 62, cast bronze and cap.
    - e. Ends: Threaded or soldered.
    - f. Disc: Bronze, with rubber or composition seat.

## 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.
- 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 check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

# 3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

# 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or butterfly valves.
  - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  - 3. Throttling Service: Ball or butterfly valves.
  - 4. Pump Discharge: Swing Check Valves
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated.
  - 3. For Steel Piping, NPS 2 and Smaller: Threaded or grooved ends.
  - 4. For Steel Piping, NPS 2-1/2 and Larger: Flanged or grooved ends.

# 3.5 VALVE SCHEDULE

# A. Pipe NPS 2 and Smaller:

- 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
- 2. Ball Valves: Two-piece, full port, bronze with bronze trim.
- 3. Bronze Swing Check Valves: Class 125, bronze disc.

# B. Pipe NPS 2-1/2 and Larger:

- 1. Iron Valves: May be provided with grooved, threaded or flanged ends.
- 2. Ball Valves: Class 150.
- 3. Iron, Single-Flange Butterfly Valves: 150 CWP, EPDM or NBR seat, epoxy coated, ductile-iron disc.
- 4. Iron, Grooved-End Butterfly Valves: 175 CWP.
- 5. Iron Swing Check Valves: Class 125 metal seats.

#### SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 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 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for plumbing 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.

#### 1.4 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 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: Pre-galvanized 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.

# B. Copper Pipe 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 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. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
  - 2. Standard: MFMA-4.
  - 3. Channels: Continuous slotted steel channel with inturned 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 carbon steel.
  - 6. Metallic Coating: Electroplated zinc or Hot-dipped galvanized.
  - 7. Paint Coating: Vinyl alkyd.

# 2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

## 2.5 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless-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.

# 2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

# 2.7 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, non-shrink and nonmetallic grout; suitable for interior and exterior applications:
  - 1. Properties: Non-staining, 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. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- D. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- E. Install hangers and supports to allow controlled thermal 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.
- F. Install lateral bracing with pipe hangers and supports to prevent swaying.
- G. 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.
- H. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- I. 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.
- J. 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.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

## 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel support 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.

#### 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. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- B. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- C. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- D. Use copper-plated pipe hangers and copper attachments for uninsulated copper piping and tubing.
- E. Use thermal-hanger shield inserts for insulated piping and tubing.

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- 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 non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. 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.
  - 3. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
  - 4. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
  - 5. 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.
  - 6. 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.
  - 7. 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.
  - 8. 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.
- 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. 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.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
  - 2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  - 3. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  - 4. C-Clamps (MSS Type 23): For structural shapes.

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- 5. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
- 6. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- 7. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
- 8. Side-Beam Brackets (MSS Type 34): For sides of steel beams.
- 9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- 10. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

# SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

## PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

## A. Section Includes:

- 1. Elastomeric isolation pads.
- 2. Elastomeric isolation mounts.

# 1.3 SUBMITTALS

- A. Product Data: For each type of product and the following:
  - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
  - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

## 1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

# PART 2 - PRODUCTS

# 2.1 ELASTOMERIC ISOLATION PADS (EIP)

- A. Elastomeric Isolation Pads:
  - 1. Acceptable manufacturers include but are not limited to the following:
    - a. Mason Industries, Inc. Type Super W Pad

- b. Kinetics Noise Control, Inc. Type RSP
- c. Vibration Mountings & Controls, Inc. Type NRC
- 2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area. Acceptable manufacturers include but are not limited to the following:
  - a. Mason Industries, Inc. Type Super W Pad
  - b. Kinetics Noise Control, Inc. Type RSP
  - c. Vibration Mountings & Controls, Inc. Type NRC
- 3. Size: Factory or field cut to match requirements of supported equipment.
- 4. Pad Material: Oil and water resistant with elastomeric properties.
- 5. Surface Pattern: Waffle pattern.

# 2.2 ELASTOMERIC ISOLATION MOUNTS (EIM)

- A. Double-Deflection, Elastomeric Isolation Mounts:
  - 1. Acceptable manufacturers include but are not limited to the following:
    - a. Mason Industries, Inc. Type Super ND
    - b. Kinetics Noise Control, Inc. Type RD
    - c. Vibration Mountings & Controls, Inc. Type RVD
  - 2. Mounting Plates:
    - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts (as necessary).
    - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

#### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation for compliance with requirements for installation tolerances and other conditions affecting performance of the work.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to anticipated forces.

C. Strength of Support: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

#### 3.3 VIBRATION-CONTROL DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for reinforcement and formwork.
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.
- C. Comply with requirements in other Sections of the Specifications for installation of roof curbs, equipment supports, and roof penetrations.

## D. Equipment Restraints:

- 1. Install snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

## F. Drilled-in Anchors:

- Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
- 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
- 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavyduty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
- 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
- 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
- 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

**END OF SECTION 230548** 

#### SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 COORDINATION

- 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.
- D. Identification of Equipment in Concealed Space: All equipment and valves concealed in ceiling space shall be identified in this manner: Use a professional labeling machine and ½ inch clear tape with black type. Place the label of the equipment on the grid of the ceiling tile directly under the equipment housed above.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: White.
  - 3. Background Color: Black.
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 6. 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-fourths the size of principal lettering.
- 7. Fasteners: Stainless-steel rivets or self-tapping screws.
- 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's drawing designation or unique equipment number and the system it is a component of (ie: HWB-1/HWP-1 indicating that HWB-1 is served from HWP-1).
- 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), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

# 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8-inch-thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. 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-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

# 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

- C. Self-Adhesive Pipe Labels: Printed plastic with contact type, permanent adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, 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 1-1/2 inches high.

## 2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 1-1/4 inches for ducts and 3/4 inch for piping access panels and door labels:
  - 1. Stencil Material: Aluminum.
  - 2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

## 2.5 DUCT LABELS

- A. General Requirements for Manufactured Duct Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Self-Adhesive Pipe Labels: printed plastic with contact-type, permanent-adhesive backing.
- C. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction:
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
  - 2. Lettering Size: At least 1-1/2 inches high.

# 2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers:
  - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass beaded chain or nylon ziptie.

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses:
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## 2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing:
  - 1. Size: 3 by 5-1/4 inches minimum.
  - 2. Fasteners: Brass grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Yellow background with black lettering.

#### PART 3 - EXECUTION

### 3.1 GENERAL

A. Contractor shall coordinate all equipment identification with Owner, Owner's representative, and drawings prior to labeling equipment. All equipment labels shall be approved by Owner. Provide a coordinated list with as-built documents that shows original equipment names compared to final Owner-approved names.

### 3.2 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- B. All concealed equipment and valves shall be identified as shown on the drawings and specifications. In addition, all valves, and equipment in concealed areas shall be identified on the ceiling grid and access panels with valve number and equipment identification. Using professional labeling machine and ½ inch tape identification on the ceiling grid shall be black letters on clear tape directly under the equipment or valves.

## 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.

#### 3.4 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule Coordinate color scheme with Owner's standard or preference. If the Owner does not have a standard or preference, use ANSI/ASME Standards.

## 3.5 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
  - 1. Green background with white letters: For supply air ducts.
  - 2. Blue background with white letters: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
  - 3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of self-adhesive duct labels, at Installer's option, if lettering larger than 1-1/2 inches high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

#### 3.6 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawnwatering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

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- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. All Applications: 1-1/2 inches, round.
  - 2. Valve-Tag Color:
    - a. All Applications: Natural brass with black letters/numbers.
  - 3. Letter Color:
    - a. All Applications: Black.

## 3.7 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

# SECTION 230593 - TESTING, ADJUSTING AND BALANCING

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. Division 019113, 019114, 019115, and 230800 related to Commissioning and 230900 Instrumentation Control for HVAC and 230993 Sequence of Operations applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- D. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives, including the following: NOTE: Balancing contractor will be hired directly by the Mechanical Contractor. Mechanical Contractor will coordinate with balancing contractor as required to properly balance systems. The Mechanical Contractor shall be required to cooperate fully with the Balancing Contractor. The contractor shall be on-site as required and make all corrective actions identified by the balancing contractor at no additional cost to the Owner. The Balancing Contractor shall report to the Mechanical Contractor including but not limited to when to be on site, project schedule, and provide preliminary TAB reports and findings directly to the Mechanical Contractor and concurrently with Engineer to expedite any additional corrective work by Mechanical Contractor.
  - 1. Balancing airflow and waterflow within new and existing distribution systems, including submains, branches, and terminals, to indicated quantities according to specified tolerances.
  - 2. Adjusting total HVAC systems to provide indicated quantities.
  - 3. Measuring electrical performance of HVAC equipment.
  - 4. Setting quantitative performance of HVAC equipment.
  - 5. Verifying that automatic control devices are functioning properly.
  - 6. Reporting results of the activities and procedures specified in this Section.

## B. Related Sections include the following:

1. Testing and adjusting requirements unique to systems and equipment are included in the Sections that specify those systems and equipment.

- 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.
- C. The Balancing Contractor shall fully coordinate with Mechanical & Controls Contractor and include all reports/communications to include the Mechanical Contractor in addition to the Owner/Engineer/Clerk-of-the-Works and Commissioning Agent at no additional costs.
- D. The intent is to rebalance the existing primary hot water pumps (P-1 and P-2 lead/lag) as well as existing pumps P-9, P-10, and P-13. The new boiler pumps HWP-1, HWP-2, HWP-3, and flow through new boilers B-1, B-2, B-3 and flow through new hot unit water unit heater UH-1. The new supply ventilation system for the boiler room including supply fan SF-1 shall also be balanced.
- E. If the Owner/Engineer must get involved with coordinating the Balancing Contractor's work with the Temperature Controls/Mechanical Contractor work, then the Temperature Controls/Mechanical Contractor and/or Balancing Contractor shall reimburse the Owner/Engineer for Owner/Engineer's efforts on a Time and Material basis by crediting the Owner/Engineer on outstanding portions of payment requests due the Controls Contractor or the Balancing Contractor. Engineer shall make sole determination as to which contractor is responsible for crediting the Owner/Engineer.

#### 1.3 SUBMITTALS

- A. If Submittals are rejected more than once, then the Submitting Contractor's application for payment shall be reduced by \$2,500 or the Engineer's time and materials cost, whichever is greater, to pay the Engineer for his service before the re-submittal is reviewed. In addition, for each re-submittal thereafter, the Submitting Contractor's application for payment shall be reduced by an additional \$2,500 to pay the Engineer for his additional time reviewing re-submittals. No time extension will be granted for project completion because of the submittals being rejected.
- B. Quality-Assurance Submittals: Within 14 days from the Owner/Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- C. Contract Documents Examination Report: Within 14 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- D. Strategies and Procedures Plan: Within 14 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
- E. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent. Provide electronic submissions in PDF or preapproved method as agreed to with Engineer/Owner. Provide hard copies as requested by the Owner.

F. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms (electronic submissions in PDF or preapproved method as agreed to with Engineer/Owner).

#### 1.4 QUALITY ASSURANCE

- A. Agent Qualifications: Engage a Testing, Adjusting, and Balancing agent certified by AABC. TAB Contractors shall be one of the following or shall be preapproved by Engineer:
  - 1. Kahoe Air Balance Company: 35601 Curtis Blvd., Eastlake, OH 44095. Phone (440) 946-4300, Fax (440) 946-2553.
  - 2. Performance HVAC Systems: 511 Bloch Street, Bramwell, WV 24715. Phone (304) 248-7222, Fax (304) 248-8447.
  - 3. Thermal Balance Company: 109 Wind Haven Drive, Suite 101, Nicholasville, KY 40356. Phone (859) 277-6158, Fax (859) 278-1010.
  - 4. Velocity TAB Services: Chris Ellis, 1421 Mercer West Middlesex Road, Mercer, PA 16131, Mobile Phone (724) 992-8777
  - 5. WAE Balancing, Inc.: 15 Tripplewood Drive, Mercer, PA 16137. Phone (724) 662-5743, Fax 724-662-1729.
- B. Testing, Adjusting, and Balancing Conference: Coordinate and schedule a pre-TAB conference to review and familiarize all representatives with the TAB procedures, plan and strategies, and to develop a mutual understanding of the details. The following representatives are to be notified of the scheduled meeting time and location a minimum of 7 days prior to TAB Conference.
  - 1. A Testing and Balancing contractor (required to be present).
  - 2. Mechanical Contractor (required to be present).
  - 3. Equipment manufacturer's authorized service personnel (required to be present).
  - 4. Control contractor (required to be present).
  - 5. Design Engineer
  - 6. Owner's Maintenance/Facilities Director and maintenance personnel
  - 7. Clerk-of-the-Works
- C. Agenda Items: Include at least the following:
  - 1. Submittal distribution requirements.
  - 2. Contract Documents examination report.
  - Testing, adjusting, and balancing plan.
  - 4. Work schedule and Project site access requirements.
  - 5. Coordination and cooperation of trades and subcontractors.
  - 6. Coordination of documentation and communication flow.
- D. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.

- 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- E. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing".
- F. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- G. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

## 1.5 PROJECT CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### 1.6 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide two (2) weeks' advance notice for each test. Include scheduled test dates and times. This notification shall be provided to the Owner's Representative.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air distribution systems have been satisfactorily completed.
- D. The Balancing Contractor shall fully coordinate with the Controls Contractor and Mechanical Contractor. Balancing shall not commence until mechanical systems are complete and operational as required due to the phased construction which likely involves some systems to be ready to balance while construction is still occurring on others. Monitor construction schedule and provide balancing of systems as required for Owner's beneficial use of the facility even if that means balancing portions of the systems before all are installed. The Balancing Contractor shall contact the Mechanical and Controls Contractors directly as needed to meet schedule and provide a working system.

### 1.7 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

- B. National Project Performance Guarantee: Provide a guarantee in a method acceptable to the Engineer or on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
  - 1. The certified Agent has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

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.
  - Contract Documents are defined in the General and Supplementary Conditions of the Contract.
  - Verify that balancing devices such as test ports, gage coils, thermometer wells, flow-control devices, balancing valves, fittings and manual volume dampers are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation. Notify Engineer of any discrepancies during bidding for clarification so all costs are included in base bid.
- B. Examine the approved submittals for HVAC systems and equipment. Submittals for previously installed HVAC equipment to be reused are available from the Engineer upon request to assist in the TAB efforts.
- C. 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.
- D. Examine ceiling plenums for return air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- E. Examine equipment performance data including fan 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.

- 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's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- G. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- I. Examine test reports specified in individual system and equipment Sections.
- J. 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.
- K. Examine terminal units and verify that they are accessible, and their controls are connected and functioning.
- L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- M. Examine operating safety interlocks and controls on HVAC equipment.
- N. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices operate by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in mixing boxes.
  - 4. Thermostats located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 5. Sensors are located to sense only the intended conditions.
  - 6. Sequence of operation for control modes is according to the Contract Documents.
  - 7. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  - 8. Interlocked systems are operating.
  - 9. Changeover from heating to cooling mode occurs according to design values.
  - 10. Automatic modulating and shutoff valves are properly connected.
- O. 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:

#### Airside:

- a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
- b. Permanent electrical power wiring is complete.
- c. Duct systems are complete with terminals installed.
- d. Volume, smoke, and fire dampers are open and functional.
- e. Clean filters are installed.
- f. Fans are operating, free of vibration, and rotating in correct direction.
- g. Variable-frequency controllers' startup is complete, and safeties are verified.
- h. Automatic temperature-control systems are operational.
- i. Ceilings are installed.
- j. Equipment and duct access doors are securely closed.
- k. Balance dampers are open.
- I. Windows and doors can be closed so design conditions for system operations can be met.
- m. Suitable access to balancing devices and equipment is provided.

# 2. Hydronics:

- a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
- b. Piping is complete with terminals installed.
- c. Water treatment is complete.
- d. Systems are flushed, filled, and air purged.
- e. Strainers are pulled and cleaned.
- f. Control valves are functioning per the sequence of operation.
- g. Shutoff and balance valves have been verified to be 100 percent open.
- h. Pumps are started and proper rotation is verified.
- i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. 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" 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 according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Division 23 Section "Piping Insulation."
- 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. The Balancing Contractor shall notify the Owner's representative and Engineer when all testing and balancing procedures on each system are being performed so the representative may witness any of the testing they desire. The Balancing Contractor shall cooperate fully in providing test data and commissioning efforts as requested by the Engineer. Notification shall be two (2) weeks in advance of scheduled visit.
- E. Take and report testing and balancing measurements in inch-pound units.
- F. The Mechanical Contractor shall be responsible for furnishing and installing any additional balancing devices required to properly balance the systems as determined by the TAB contractor and/or the Engineer, at no additional cost to the Owner.

### 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 static pressure profile diagrams of air handling systems. Static pressure profiles shall include all sections from the return/exhaust duct inlet and supply duct outlet of each air handling system. Show accurate representation of return, relief, outdoor and economizer damper locations. On units equipped with exhaust air fans; show location and profile of the exhaust fan.
- 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 in Section 233113 "Metal Ducts."
- L. The Mechanical Contractor shall furnish and install a second set of sheaves and belts, other than those provided with the mechanical equipment at delivery, if required for proper balancing, at no additional cost to the Owner.

#### 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 outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection or through the wall of the unit.
    - c. Measure static pressure directly at the fan inlet or through the flexible connection or through the wall of the unit.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
    - e. Measure static pressure across each component that makes up the airhandling system to develop a unit static pressure profile.
    - f. 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 Engineer 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. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    - a. Where sufficient space in submains and branch ducts is unavailable for Pitottube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submains and branch ducts to design airflows within specified tolerances.
- 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 SINGLE ZONE VARIABLE-AIR-VOLUME SYSTEMS

- A. Same as Constant Air Volume System except as follows:
  - Verify that the system is under control and obtain maximum and minimum recommended air flows from AHU manufacturer for proper operation of all system and do not operate outside those values. Coordinate those setting with Mechanical Contractor and Control Contractor and note them on the TAB report for future reference
  - 2. Select the supply outlet that is most critical to the supply-fan airflow.
  - 3. Calibrate and balance each AHU unit for maximum and minimum design airflow as follows:
    - Adjust controls so that AHU is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
    - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
    - c. When maximum airflow is correct, balance the air outlets downstream.
    - d. Adjust controls so that terminal is calling for minimum airflow.

- e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
- 4. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
  - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions and full cooling load.
  - 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.
- 5. 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 airhandling system to develop a unit static pressure profile.
  - d. Report any artificial loading of filters at the time static pressures are measured.
- 6. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
  - a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
  - b. Verify that terminal units are meeting design airflow under system maximum flow.
- 7. Verify final system conditions as follows:
  - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
  - b. Re-measure and confirm that total airflow is within design.
  - c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
  - d. Mark final settings.
  - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
  - f. Verify tracking between supply and relief fans.

## 3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
  - 1. Open all manual valves for maximum flow.

- 2. Check liquid level in expansion tank.
- 3. Check highest vent for adequate pressure.
- 4. Check flow-control valves for specified sequence of operation and set at design flow.
- 5. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- 6. Verify that motor starters are equipped with properly sized thermal protection.
- 7. Check that air has been purged from the system.
- 8. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.

## 3.8 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
  - 1. Verify that the differential-pressure sensor is located as indicated.
  - 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
  - 1. Adjust pumps to deliver total design gpm.
    - a. Measure total water flow using ultrasonic flow meter as required.
      - 1) Position valves for full flow through coils.
      - Measure flow by main flow meter, using TAB furnished ultrasonic flow meter and coordinate location for measuring flow with mechanical contractor and coordinate removal of pipe insulation/reinstallation of pipe insulation as necessary for proper measurement and calibration of flow meter with ATC.
      - 3) Also compare flow meter flow rates with determining flow by pump TDH or exchanger pressure drop.
    - b. Measure pump TDH as follows:
      - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      - 3) Convert pressure to head and correct for differences in gage heights.
      - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
      - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
    - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
    - d. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on the pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the

- pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
- e. Report flow rates that are not within plus or minus 5 percent of design.
- 2. Adjust flow-measuring devices installed in mains and branches to design water flows.
  - a. Measure flow in main and branch pipes.
  - b. Adjust main and branch balance valves for design flow.
  - Re-measure each main and branch after all have been adjusted.
- 3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - a. Measure flow at terminals.
  - b. Adjust each terminal to design flow.
  - c. Re-measure each terminal after it is adjusted.
  - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
  - e. Perform temperature tests after flows have been balanced.
- 4. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - a. Measure and balance coils by either coil pressure drop or temperature method.
  - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- 5. Prior to verifying final system conditions, determine the system differential-pressure set point.
- 6. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
- 7. Mark final settings and verify that all memory stops have been set.
- 8. Verify final system conditions as follows:
  - a. Re-measure and confirm that total water flow is within design.
  - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
  - c. Mark final settings.
- 9. Verify that memory stops have been set and record VFD setting to meet design gpm and minimum gpm. Minimum gpm shall be verify with pump manufacturer to avoid improper operation of pumps.

## 3.9 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.

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- 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test manual bypass of controller to prove proper operation. Record observations, including controller information.

#### 3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first.
- B. Balance the secondary circuits after the primary circuits are complete.
- C. Adjust pumps to deliver total design flow.
  - 1. Measure total water flow.
    - a. Position valves for full flow through coils.
    - b. Measure flow by main flow meter, if installed.
    - c. If main flow meter is not installed, determine flow by pump TDH or known equipment pressure drop.
  - 2. Measure pump TDH as follows:
    - Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
    - b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
    - c. Convert pressure to head and correct for differences in gauge heights.
    - d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
    - e. With valves open, read pump TDH. Adjust pump discharge valve or speed until design water flow is achieved. If excessive throttling is required to achieve desired flow, recommend pump impellers be trimmed to reduce excess throttling.
  - 3. Monitor motor performance during procedures, and do not operate motor in an overloaded condition.
- D. Adjust flow-measuring devices installed in mains and branches to design water flows.
  - 1. Measure flow in main and branch pipes.
  - 2. Adjust main and branch balance valves for design flow.
  - 3. Re-measure each main and branch after all have been adjusted.
- E. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - 1. Measure flow at terminals.
  - 2. Adjust each terminal to design flow.
  - 3. Re-measure each terminal after it is adjusted.
  - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
  - 5. Perform temperature tests after flows have been balanced.

- F. For systems with pressure-independent valves at terminals:
  - 1. Measure differential pressure and verify that it is within manufacturer's specified range.
  - 2. Perform temperature tests after flows have been verified.
- G. For systems without pressure-independent valves or flow-measuring devices at terminals:
  - 1. Measure and balance coils by either coil pressure drop or temperature method.
  - 2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
- H. Verify final system conditions as follows:
  - 1. Re-measure and confirm that total water flow is within design.
  - 2. Re-measure final pumps' operating data, TDH, volts, amps, speed, and static profile.
  - 3. Mark final settings.
- I. Verify that memory stops have been set.

## 3.11 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each electric heating coil:
  - 1. Nameplate data.
  - Airflow.
  - 3. Entering- and leaving-air temperature at full load.
  - 4. Voltage and amperage input of each phase at full load.
  - 5. Calculated kilowatt at full load.
  - 6. Fuse or circuit-breaker rating for overload protection.
- B. Measure, adjust, and record the following data for each refrigerant coil:
  - 1. Dry-bulb temperature of entering and leaving air.
  - 2. Wet-bulb temperature of entering and leaving air.
  - 3. Airflow.

# 3.12 DUCT LEAKAGE TESTS

- A. Verify that the Mechanical Contractor's proper test methods are used and that leakage rates are within specified tolerances.
- B. Report deficiencies observed.
- C. If the TAB Contractor is hired by the mechanical Contractor to perform Duct Leakage testing, the testing shall be performed in accordance with the requirements set forth in Division 23 Section "Metal Ducts".

#### 3.13 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Take sufficient measurements to verify DDC sensors are reading accurately working with DDC Controls contactor including the indoor wet- and dry-bulb temperatures and compare to DDC readings, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied or when approved by the Engineer when the space HVAC system is under load but unoccupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

## 3.14 CONTROLS VERIFICATION

- A. Verify that controllers (room and duct temperature sensors) are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Verify operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Verify free travel and proper operation of control devices such as damper operators.
- F. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow measurements. Note the speed of response to input changes.
- G. Confirm interaction of electrically operated switch transducers.
- H. Confirm interaction of interlock and lockout systems.
- I. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.
- J. Note operation of electric actuators using spring return for proper fail-safe operations.
- K. In conjunction with system balancing, perform the following:
  - 1. Verify temperature control system is operating within the design limitations.
  - 2. Confirm that the sequences of operation are following Contract Documents.
  - 3. Verify that controllers are calibrated and function as intended.
  - 4. Verify that controller set points are as indicated.
  - 5. Verify the operation of lockout or interlock systems.
  - 6. Verify the operation of valve and damper actuators.
  - 7. Verify that controlled devices are properly installed and connected to correct controller.

- 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
- 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- L. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

#### 3.15 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to 10 percent.
  - 2. Air Outlets and Inlets: Plus, or minus 10 percent.
  - 3. Heating-Water Flow Rate: Plus, or minus 5 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.16 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: As work progresses prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.
- C. The Engineer shall be provided copies of all copies of all correspondence between the Tab Contractor and any other Contractor relative to the Tab work, including any deficiency reports.

## 3.17 FINAL REPORT

- A. General: Prepare a certified type written report in "smart" PDF format (indexed for easy search) and one (1) hard copy each for the Owner and Engineer; 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's 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. Pump curves.
  - Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
  - 6. In addition to PDF and hard copies, all test data and equipment data shall be furnished in Microsoft Excel or Word format burned to a labeled CD and e-mailed to Engineer.
- 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. Engineer's name and address.
  - 6. Contractor's name and address.
  - 7. Report date.
  - 8. Signature of TAB supervisor who certifies the report.
  - 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 10. Summary of contents including the following:
    - a. Design versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 11. Nomenclature sheets for each item of equipment.
  - 12. Notes to explain why certain final data in the body of reports vary from indicated values.
  - 13. Test conditions for fans and pump performance forms including the following:
    - a. Conditions of filters.
    - b. Setting for outdoor, return and exhaust air dampers.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Fan drive settings including settings and percentage of maximum pitch
    - e. Settings for supply-air, static-pressure controller.
    - f. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Quantities of outdoor, supply, return, and exhaust airflows.
  - 2. Duct, outlet, and inlet sizes.
  - 3. Pipe and valve sizes and locations.
  - 4. Balancing stations.
  - Position of balancing devices.
- E. 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 (Design and Actual Values): Provide static pressure profile of data points.
  - a. Total airflow rate in cfm.
  - b. Total system static pressure in inches w.g.
  - c. Fan rpm.
  - d. Discharge static pressure in inches w.g.
  - e. Filter static-pressure differential in inches w.g.
  - f. Preheat-coil static-pressure differential in inches w.g.
  - g. Cooling-coil static-pressure differential in inches w.g.
  - h. Heating-coil/section static-pressure differential in inches w.g.
  - i. Outdoor airflow in cfm.
  - j. Return airflow in cfm.
  - k. Outdoor-air damper position.
  - I. Return-air damper position.
  - m. Unit entering and leaving air temperatures for full cooling and heating operation.

# F. Apparatus-Coil Test Reports:

- 1. Coil Data:
  - a. System identification.
  - b. Location.
  - c. Coil type.
  - d. Number of rows.
  - e. Fin spacing in fins per inch o.c.
  - f. Make and model number.
  - g. Face area in sq. ft.
  - h. Tube size in NPS.
  - i. Tube and fin materials.
  - j. Circuiting arrangement.

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- 2. Test Data (Design and Actual Values):
  - a. Airflow rate in cfm.
  - b. Average face velocity in fpm.
  - c. Air pressure drop in inches wg.
  - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
  - e. Return-air, wet- and dry-bulb temperatures in deg F.
  - f. Entering-air, wet- and dry-bulb temperatures in deg F.
  - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- G. 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 (Design 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.
- H. Round 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. Design airflow rate in cfm.
    - h. Design velocity in fpm.
    - i. Actual airflow rate in cfm.
    - j. Actual average velocity in fpm.

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- k. Barometric pressure in psig.
- I. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:
  - 1. Unit Data:
    - Unit identification.
    - b. Location.
    - c. Service.
    - d. Make and size.
    - e. Model number and serial number.
    - f. Water flow rate in gpm.
    - g. Water pressure differential in feet of head or psig.
    - h. Required net positive suction head in feet of head or psig.
    - i. Pump rpm.
    - j. Impeller diameter in inches.
    - k. Motor make and frame size.
    - I. Motor horsepower and rpm.
    - m. Voltage at each connection.
    - n. Amperage for each phase.
    - o. Full-load amperage and service factor.
    - p. Seal type.
  - 2. Test Data (Design and Actual Values):
    - Static head in feet of head or psig.
    - b. Pump shutoff pressure in feet of head or psig.
    - c. Actual impeller size in inches.
    - d. Full-open flow rate in gpm.
    - e. Full-open pressure in feet of head or psig.
    - f. Final discharge pressure in feet of head or psig.
    - g. Final suction pressure in feet of head or psig.
    - h. Final total pressure in feet of head or psig.
    - i. Final water flow rate in gpm.
    - j. Voltage at each connection.
    - k. Amperage for each phase.
- J. Instrument Calibration Reports:
  - 1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

## 3.18 VERIFICATION OF TAB REPORT

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
- 2. Check the following for each system:
  - a. Measure airflow of at least 10 percent of air outlets.
  - b. Measure water flow of at least 10 percent of terminals.
  - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
  - d. Verify that balancing devices are marked with final balance position.
  - e. Note deviations from the Contract Documents in the final report.

# B. Final Inspection:

- 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by the Engineer.
- 2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of the CxA and Engineer (Engineer to attend at their option).
- 3. Engineer/CxA shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 20 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day with this occurring at five different points during the construction for up to 5 days as necessary and to support Commissioning activities.
- 4. 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."
- 5. 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.

## C. 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, Owner and/or Engineer may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- D. Prepare test and inspection reports.

#### 3.19 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.

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- 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.
- C. The Test and Balance Contractor shall be present during the commissioning activities as requested by the Engineer/CxA. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be confirmed.

END OF SECTION 230593

#### SECTION 230713 - DUCT INSULATION

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

- A. Section includes insulating material for the following duct services:
  - 1. Indoor, concealed supply air.
  - 2. Other as indicated on the drawings.

## 1.3 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 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 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.

### 1.5 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 20 Section "Hangers and Supports for HVAC and Plumbing Piping and Equipment."
- 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.

#### 1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "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. Flexible Elastomeric Insulation Indoor Use: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA.
    - d. Owens Corning
- D. Flexible Elastomeric Insulation shall have the following properties:
  - 1. Thermal Conductivity Through 1 Inch: 0.25 BTU-in/h-ft2-°F at 75°F mean temperature and 0.256 BTU-in/h-ft2-°F at 90° F mean temperature as tested per ASTM C177 or C518.
  - 2. Thermal Conductivity 1-1/2 Inches and 2 Inches: 0.28 BTU-in/h-ft2-°F at 75°F mean temperature and 0.286 BTU-in/h-ft2-°F at 90°F mean temperature as tested per ASTM E96, Procedure A.
  - 3. Water Vapor Permeability: 0.05 Perm-in as tested per ASTM E96, Procedure A.
  - 4. Flame Spread and Smoke Developed Index: 25/50 (1" thick and below).
  - 5. Maximum Continuous Service Temperature: 220° F
  - 6. Connections: Waterproof vapor retarder adhesive as needed for end connections and seams; self-sealing longitudinal seams are acceptable.

- 7. UV Protection: Where exposed to outdoors and not jacketed, provide UV protective coatings.
- 8. Colors: Where concealed or not visible provide manufacturer's standard or black; where exposed to view provide insulation with white finish.
- E. Mineral-Fiber Blanket Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II 1.5 lb density without facing and with factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- F. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB 6 lb. density. For duct and plenum applications, provide insulation with factory-applied all service jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

#### G. Glass Fiber Insulation

- 1. Description
  - a. Fiberglass Pipe and Tank Insulation is made of semi-rigid fibrous glass board material, factory-jacketed with an FRK or ASJ Max jacket. The insulation is adhered with the end grain perpendicular to the jacket.
- 2. Standards, Codes Compliance
  - ASTM C1393 "Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks, Types I and II, Category 1
  - b. ASTM C1136, Flexible Low Permeance Vapor Retarders for Thermal Insulation, Types I, II, III and IV.
  - c. Nuclear Regulatory Commission Guide 1.36, Non-Metallic Thermal Insulation.
  - d. ASTM C795, Thermal Insulation for Use Over Austenitic Stainless Steel
  - e. Meets fire retardant decabrominated diphenyl ether (decaBDE)

#### 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. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Armacell LLC.
    - b. Childers Brand; H. B. Fuller Construction Products.
    - c. Foster Brand; H. B. Fuller.
    - d. K-Flex USA.
    - e. Aeroflex USA, Inc.; Aeroseal.
    - f. Armacell LLC; Armaflex 520 Adhesive.
    - g. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact Adhesive.</u>
  - 2. 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. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges Marathon Industries.
    - c. Foster Brand; H. B. Fuller.
    - d. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B.</u> Fuller Company; CP-127.Eagle Bridges Marathon Industries; 225.
    - e. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.Mon-Eco Industries, Inc.; 22-25.</u>
  - 2. 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: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges Marathon Industries.
    - c. Foster Brand; H. B. Fuller.
    - d. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.</u>
    - e. <u>Eagle Bridges Marathon Industries; 225.</u>
    - f. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.
    - g. Vimaso Corp: 739
  - 2. 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. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. <u>Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding</u> Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  - 2. 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: Water based; suitable for indoor use on below ambient services.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand: H. B. Fuller.
    - c. Knauf Insulation.
    - d. Vimasco Corporation.
    - e. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> Company; 30-80/30-90.
    - f. Vimasco Corporation; 749.
  - 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.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand; H. B. Fuller Construction Products.
    - b. Eagle Bridges Marathon Industries.
    - c. Foster Brand; H. B. Fuller.
    - d. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.</u>
    - e. Eagle Bridges Marathon Industries; 570.
    - f. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> Company; 60-95/60-96.
  - 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.
  - Color: White.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.</u>
    - b. Eagle Bridges Marathon Industries; 550.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.</u>
    - d. Vimasco Corporation; WC-1/WC-5.
  - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: 60 percent by volume and 66 percent by weight.
  - 5. Color: White.

# 2.4 SEALANTS

- A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Childers Brand: H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller.
    - c. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.</u>
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: White.
  - 6. 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).

# B. PVC Jacket Flashing Sealants:

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 40 to plus 250 deg F.
- 5. Color: White.
- 6. 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).

# 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. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. FSK Jacket: Aluminum Foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
- B. Aluminum-Polyester Self-Adhesive Jacket: 12 mils thick, made with alternating layers of aluminum foil and polyester film coated with cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture and tear resistance.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armacell LLC; ArmaTuff.
    - b. Venture Tape; Venture Clad (1579CW-W).

# 2.6 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
- B. Aluminum-Polyester Self-Adhesive Jacket: 12 mils thick, made with alternating layers of aluminum foil and polyester film coated with cold weather acrylic adhesive. Construction of laminate designed to provide UV resistance, high puncture and tear resistance.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armacell LLC: ArmaTuff.
    - b. Venture Tape; Venture Clad (1579CW-W).

# 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: One-piece molded type, high-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming:
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Johns Manville; Zeston, 2000.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: White.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate:
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, fittings, takeoffs, and end caps.

# 2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.

- 6. Tensile Strength: 40 lbf/inch in width.
- 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Elastomeric Foam Tape: Black vapor-retarder foam tape with acrylic adhesive containing, EPA approved anti-microbial additive.
  - 1. Products: Subject to Compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armacell LLC; AP/Armaflex Insulation Tape.
- D. Foil Tape: 6" wide foil material backed with pressure sensitive adhesive.
  - 1. Products: Subject to Compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armacell LLC; ArmaTuff Silver Seal Tape.
  - 2. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications:
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) ABI, Ideal Tape Division; 370 White PVC tape.
      - 2) Compac Corporation; 130.
      - 3) Venture Tape; 1506 CW NS.
    - b. Width: 2 inches.
    - c. Thickness: 6 mils.
    - d. Adhesion: 64 ounces force/inch in width.
    - e. Elongation: 500 percent.
    - f. Tensile Strength: 18 lbf/inch in width.

## 2.9 SECUREMENTS

A. Bands:

- 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
  - a. Johns Manville; a Berkshire Hathaway company.
  - b. <u>ITW Insulation Systems; Gerrard Strapping and Seals.</u>
  - c. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 3/4 inch wide with closed seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch, 3/4 inch wide with closed seal.

# B. Insulation Pins and Hangers:

- 1. Capacitor-Discharge-Weld Pins: Copper-coated steel pin, fully annealed for capacitor-discharge welding, with galvanized speed washer, length to suit depth of insulation indicated. Welded pin holding capacity: 100 lb for direct pull perpendicular to the attached surface.
- C. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
  - 1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.
- D. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
- E. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

# 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 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 required, 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 outdoor 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 sealants.
  - 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 Interior Wall and Partition Penetrations (that are not fire rated): Install insulation continuously through walls and partitions.
- C. 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.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" and fire-resistive joint sealers.
- D. 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. Comply with requirements in Section 078413 "Penetration Firestopping."

## 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 MINERAL-FIBER 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 anchor pins and speed washers 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 over compress insulation during installation. Compressed insulation thickness must be rated for minimum required R-value.
    - 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.
  - 5. Overlap un-faced 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.
- B. Board 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 anchor pins and speed washers 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, space 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 over compress insulation during installation.
  - e. 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.
- 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
- 6. 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 INSTALLATION OF SEMI-RIGID FIROUS GLASS BOARD INSULATION

- A. Measure the length of insulation required according to the fabrication guide located on the carton. Cut completely through the insulation and jacket. Use a flap tool to fillet a stapling flange on one end of the insulation
- B. Each 36" section of insulation may be secured around the pipe using outward clenching staples and mastic, or by applying outward clenching staples and pressure sensitive vapor retarder tape. Special care must be taken to vapor seal systems operating below ambient temperatures. Adjacent sections must be tightly butted together, then sealed with vapor retarder tape.
- C. If indoor applications will be painted, use only a water base latex paint.

# 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 aluminum-polyester jackets are indicated for application over flexible elastomeric insulation, install directly over finished insulation per the manufacturer's recommendations, but no less than 3" overlap at all seams and joints.

## C. PVC Jackets

- 1. For ductwork indicated to receive PVC jacketing, Finish with Zeston 2000 PVC jacket and fitting covers. PVC jacket and fitting covers.
- 2. PVC Plastic: Zeston 2000 or equal. One-piece molded type fitting covers and jacketing material, gloss white. Connections are permaweld adhesive; tacks or pressure sensitive color matching vinyl tape. Zeston 2000 shall have flame spread rating of 25 or less and a smoke developed rating of 50 or less.

# 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 Division 09 Section "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 UV coating.
- C. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection of the completed Work.

# 3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to no more than three location(s) per phase of work for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

# 3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, supply.
  - 2. Outdoor, supply and return ductwork
- 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.
  - 7. Testing Agency labels and stamps.
  - 8. Name plates and data plates.

# 3.12 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Service: Rectangular and round, supply-air ducts, concealed that are not internally lined and not located adjacent to noise sensitive spaces. Refer to drawings for noise sensitive space identification.
  - 1. Material: Flexible Elastomeric, minimum 1 inch thick, with painted or jacked finish.
  - 2. Material: Mineral-fiber blanket; minimum of 1-1/2" thickness with minimum installed R Value = 3.5; Factory-Applied Jacket: FSK or ASJ; Vapor Retarder Required: Yes.
- C. Service: Exposed rectangular and round, supply-air ducts, exposed in spaces that are not internally lined.
  - 1. Material: Fiberglass Insulation made of semi-rigid fibrous glass board material, factory-jacketed with an FRK or ASJ Max jacket
  - 2. PVC Plastic Jackets: Zeston 2000 or equal. One-piece molded type fitting covers and jacketing material, gloss white.

## 3.13 MECHANICAL ROOM DUCT AND PLENUM INSULATION SCHEDULE

- A. Service: Rectangular and rounded, supply-air and outdoor air ducts, concealed and exposed that are not internally lined.
  - 1. Material: High-density mineral-fiber board, minimum of 2" thickness with minimum installed R value = 6.3; Field-Applied Jacket: Aluminum; Vapor Retarder Required: Yes.

GSD-221-C

END OF SECTION 230713

## SECTION 230716 - HVAC EQUIPMENT INSULATION

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section includes insulating the following HVAC equipment that is not factory insulated:
  - 1. Existing expansion/compression tanks to be reused n tank.
  - 2. Existing air separators to be reused when damaged and in need of repair.
  - 3. Bypass feeders all existing to be reused.
  - 4. Serviceable insulated boxes for new pumps. Coordinate service clearance with MC prior to pumps/ adjacent equipment being installed.
  - 5. New HVAC equipment not factory furnished with insulation.

# B. Related Sections:

- 1. Section 230719 "Piping Insulation."
- 2. Section 230713 "Duct Insulation

# 1.3 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. 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.

## 1.4 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 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.

# 1.5 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.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required. 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 "Equipment 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 and Type II for sheet materials.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Aeroflex USA, Inc.; Aerocel.</u>
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Sheet and K-FLEX LS.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612 Type 1B, 6 lb. density. Provide insulation without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semi-rigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type 1B. Nominal density is 6.0 lb/cu. Ft. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

# 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Ramco Insulation, Inc.; Super-Stik.
- B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Ramco Insulation, Inc.; Thermokote V.
- C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

- 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
  - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

## 2.3 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. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Aeroflex USA, Inc.; Aeroseal.
    - b. <u>Armacell LLC; Armaflex 520 Adhesive.</u>
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.</u>
    - d. K-Flex USA; R-373 Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316 C, Class 2, Grade A. 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).

# 2.4 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 and outdoor use on below ambient services.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H.B. Fuller</u> Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 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.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.

- 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
  - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.</u>
  - b. <u>Eagle Bridges Marathon Industries; 570.</u>
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
- 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.
- D. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.</u>
    - b. Eagle Bridges Marathon Industries; 550.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    - d. Mon-Eco Industries, Inc.; 55-50.
    - e. Vimasco Corporation; WC-1/WC-5.
  - 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: 60 percent by volume and 66 percent by weight.
  - 5. Color: White.

# 2.5 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 low VOC when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.</u>
    - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment insulation.
  - 4. Service Temperature Range: 0 to plus 180 deg F.
  - 5. Color: White.

## 2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.</u>
    - b. Marathon Industries; 405.
    - c. <u>Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller</u> Company; 95-44.
    - d. Mon-Eco Industries, Inc.; 44-05.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
  - 6. 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).
- B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Childers Brand, Specialty Construction Brands, Inc., a business of H. B.</u> Fuller Company; CP-76.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: White.
  - 6. 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).

# 2.7 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  - 3. PVC White Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules. Factory-fabricated tank heads and tank side panels.
  - 4. <u>Manufacturers:</u> 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. Johns Manville; a Berkshire Hathaway company.
    - b. P.I.C. Plastics, Inc.

- c. Proto Corporation.
- 5. Metal Jacket: Aluminum Jacket: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14.
  - a. Sheet and roll stock ready for shop or field sizing.
  - b. Finish and thickness are indicated in field-applied jacket schedules.
  - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
  - d. Moisture Barrier for Outdoor Applications: 2.5-mil-thick polysurlyn.
  - e. Factory-Fabricated Fitting Covers:
    - 1) Same material, finish, and thickness as jacket.
    - 2) Preformed two-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.

## 2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. <u>Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW,</u> Luben 59.

## 2.9 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. Sheet and roll stock ready for shop or field sizing.
    - b. Finish and thickness are indicated in field-applied jacket schedules.
    - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
    - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
    - e. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed two-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.
- C. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.

# 2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. <u>Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.</u>
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following

- a. ABI, Ideal Tape Division; 488 AWF.
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
- c. Compac Corporation; 120.
- d. Venture Tape; 3520 CW.
- 2. Width: 2 inches.
- 3. Thickness: 3.7 mils.
- 4. Adhesion: 100 ounces force/inch in width.
- 5. Elongation: 5 percent.
- 6. Tensile Strength: 34 lbf/inch in width.

## 2.11 SECUREMENTS

## A. Bands:

- 1. <u>Products:</u> Subject to compliance with requirements, [available products that may be incorporated into the Work include, but are not limited to, the following
  - a. <u>ITW Insulation Systems; Gerrard Strapping and Seals.</u>
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 1/2 inch wide with closed seal.
- 3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

# B. Insulation Pins and Hangers:

- 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.
  - a. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
- 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.
  - a. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - 1) AGM Industries, Inc.; CHP-1.
    - 2) GEMCO; Cupped Head Weld Pin.
    - 3) Midwest Fasteners, Inc.; Cupped Head.
    - 4) Nelson Stud Welding; CHP.
- 3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

- a. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
  - 1) AGM Industries, Inc.; RC-150.
  - 2) <u>GEMCO; R-150.</u>
  - 3) Midwest Fasteners, Inc.; WA-150.
  - 4) Nelson Stud Welding; Speed Clips.
- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- 4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. <u>Manufacturers:</u> 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) GEMCO.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. <u>Manufacturers:</u> 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. C & F Wire.

#### 2.12 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

# 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 and equipment 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

# 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 equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment 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 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.
- 4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- 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.
- N. 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. Manholes (marked removable covers on systems where condensate may occur).
  - 5. Handholes (marked removable covers on systems where condensate may occur).
  - 6. Cleanouts (marked removable covers on systems where condensate may occur).

# 3.4 INSTALLATION OF EQUIPMENT, TANK, AND VESSEL INSULATION

- A. Mineral-Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels (heating hot water system): Secure insulation with adhesive and anchor pins and speed washers.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
  - 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  - 3. Protect exposed corners with secured corner angles.
  - 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    - d. Do not overcompress insulation during installation.
    - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.

- f. Impale insulation over anchor pins and attach speed washers.
- g. 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.
- 5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
- 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
- 7. Stagger joints between insulation layers at least 3 inches.
- 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
- 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
- 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels (chilled water systems): Install insulation over entire surface of tanks and vessels.
  - 1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
  - 2. Seal longitudinal seams and end joints.
- C. Insulation Installation on Pumps:
  - 1. Fabricate metal boxes lined with insulation. Pumps shall be completely insulated on all four sides. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
  - 2. Fabricate boxes from galvanized steel, at least 0.060 inch thick.
  - 3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

# 3.5 FIELD-APPLIED JACKET INSTALLATION

- A. Where FSK jackets are indicated or required, 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.
- B. Where metal jackets are indicated or required, 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.

# 3.6 FINISHES

- A. Equipment Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 Section "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 field jacketing where indicated; otherwise, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by OWNER/Engineer or as indicated where exposed to view provide insulation with white finish. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

# 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections: Inspect field-insulated equipment, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

## 3.8 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option subject to space being available.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Heating-hot-water pump insulation shall be the following:
  - 1. Flexible Elastomeric: 1 inch thick.
- D. Heating-hot-water expansion/compression tank insulation shall be the following:
  - 1. Flexible Elastomeric: 1inch thick.
- E. Heating-hot-water /bypass filter insulation shall be the following:
  - 1. Flexible Elastomeric: 1 inch thick.

# 3.9 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
  - 1. Stucco Embossed Aluminum: 0.024 inch thick.
- D. Equipment, exposed, larger than 48 inches in diameter or with flat surfaces larger than 72 inches:
  - 1. Stucco-Embossed Aluminum: 0.032 inch thick.

# 3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:
  - 1. Stucco-Embossed Aluminum: 0.024 inch thick.
- D. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

# GSD-221-C

1. Painted Aluminum with 2-1/2-inch-deep corrugations Stucco-Embossed: 0.032 inch thick.

END OF SECTION 230716

## SECTION 230719 - HVAC PIPING INSULATION

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section includes insulation for HVAC piping systems.
- B. Related Requirements:
  - 1. Section 230713 "Duct Insulation" for duct insulation.
  - 2. Section 230716 "HVAC Equipment Insulation" for equipment insulation.
  - 3. Section 232113.13 "Underground Hydronic Piping" loose-fill pipe insulation in underground piping outside the building.

# 1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

## 1.4 INFORMATIONAL SUBMITTALS

A. 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.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size, as well as ASTM standard designation, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- 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. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

# 2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.
  - 1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

# 2.2 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," Underground Piping Insulation Schedule" articles for where insulating materials are applied.
- B. Products do not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

- D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.
- E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.
- F. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.
  - 1. <u>Basis-of-Design Product:</u> Subject to compliance with requirements, provide product by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Owens Corning.
  - 2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
  - 3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
  - 4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- G. Glass-Fiber, Pipe and Tank: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 850 deg F, in accordance with ASTM C411. Comply with ASTM C1393.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. Johns Manville; a Berkshire Hathaway company.
    - b. Knauf Insulation.
    - c. Owens Corning.
  - 2. Semirigid board material with factory-applied ASJ FSK jacket.
  - Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

# 2.3 INSULATING CEMENTS

- A. Glass-Fiber and Mineral Wool Insulating Cement: Comply with ASTM C195.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
    - a. Ramco Insulation, Inc.

# 2.4 ADHESIVES

- A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Glass-Fiber and Mineral Wool Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

- 1. <u>Manufacturers:</u> 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. Childers Brand; H. B. Fuller Construction Products.
  - b. Foster Brand; H. B. Fuller.
  - c. Mon-Eco Industries, Inc.
- 2. <u>Adhesive:</u> As recommended by mineral fiber manufacturer and with a VOC content of 80 g/L or less.
- 3. <u>Verify adhesive complies with the</u> testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. <u>Manufacturers:</u> 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. Johns Manville; a Berkshire Hathaway company.
    - b. The Dow Chemical Company.
  - 2. <u>Adhesive:</u> As recommended by Adhesive PVC Jacket manufacturer and with a VOC content of 50 g/L or less.
  - 3. <u>Verify adhesive complies with the</u> testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

# 2.5 MASTICS AND COATINGS

- A. Materials are compatible with insulation materials, jackets, and substrates.
  - 1. <u>Mastics:</u> As recommended by insulation manufacturer and with a VOC content of 50 g/L or less.
  - 2. <u>Verify mastics comply with the</u> testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.
  - 1. <u>Manufacturers:</u> 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. Childers Brand; H. B. Fuller Construction Products.
    - b. Knauf Insulation.
    - c. Vimasco Corporation.
  - 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
  - 3. Service Temperature Range: 0 to plus 180 deg F.

- 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD Qualified Products Database.
- 5. Color: White.
- C. Vapor-Retarder Mastic, Solvent Based, Indoor Use: Suitable for indoor use on below-ambient services.
  - 1. <u>Manufacturers:</u> 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. Childers Brand: H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller.
    - c. Mon-Eco Industries, Inc.
  - 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
  - 3. Service Temperature Range: 0 to 180 deg F.
  - 4. Color: White .
- D. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.
  - 1. <u>Manufacturers:</u> 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. Childers Brand; H. B. Fuller Construction Products.
    - b. Foster Brand; H. B. Fuller.
  - 2. Water-Vapor Permeance: Comply with ASTM E96/E96M or ASTM F1249.
  - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
  - Color: White .
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. <u>Manufacturers:</u> 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. Childers Brand; H. B. Fuller Construction Products.
    - b. Knauf Insulation.
    - c. Vimasco Corporation.
  - 2. Water-Vapor Permeance: ASTM E96/E96M, greater than 1.0 perm at manufacturer's recommended dry film thickness.
  - 3. Service Temperature Range: 0 to plus 180 deg F.
  - 4. Color: White .

## 2.6 SEALANTS

- A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.
- B. Joint Sealants:

- 1. <u>Manufacturers:</u> 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. Childers Brand; H. B. Fuller Construction Products.
  - b. Foster Brand; H. B. Fuller.
  - c. Owens Corning.
- 2. Permanently flexible, elastomeric sealant.
  - a. Service Temperature Range: Minus 150 to plus 250 deg F.
  - b. Color: White or gray.
- 3. <u>Verify sealant has a VOC</u> content of 420 g/L or less.
- 4. <u>Verify sealant complies with the</u> testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

# 2.7 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: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.
  - 2. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

# 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. <u>Manufacturers:</u> 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. Johns Manville; a Berkshire Hathaway company.
    - b. Proto Corporation.
    - c. Speedline Corporation.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: White.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:

- 1. <u>Manufacturers:</u> 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. Johns Manville; a Berkshire Hathaway company.
  - b. RPR Products, Inc.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.
  - 1. <u>Manufacturers:</u> 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. 3M Industrial Adhesives and Tapes Division.
    - b. Ideal Tape Co., Inc., an American Biltrite Company.
    - c. Knauf Insulation.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

## 2.10 SECUREMENTS

## A. Bands:

- 1. <u>Manufacturers:</u> 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. Johns Manville; a Berkshire Hathaway company.
  - b. RPR Products, Inc.
- 2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal .
- 3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal .
- 4. Springs: Twin spring set constructed of stainless steel, with ends flat and slotted to accept metal bands. Spring size is determined by manufacturer for application.
- B. Staples: Outward-clinching insulation staples, nominal 3/4 inch wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire Products.
    - b. Johns Manville; a Berkshire Hathaway company.

c. RPR Products, Inc.

## 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. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
  - 2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

# 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 of 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, compress, or otherwise damage insulation or jacket.

- D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) 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 storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.
- 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 attached to structure with vapor-barrier mastic.
  - 3. Install insert materials and 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, but not to the extent of creating wrinkles or areas of compression in the insulation.
  - 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 2 inches o.c.
  - 4. For below-ambient services, apply vapor-barrier mastic over staples.
  - 5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
  - 6. 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.

- 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 in similar fashion 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.

### 3.4 PENETRATIONS

- A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations 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: 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.
- E. 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 below.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is 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 prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that 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 prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 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 prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 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, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
  - 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 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.
- Insulate instrument connections for thermometers, pressure gages, pressure C. temperature taps, test connections, flow meters, sensors, switches, and transmitters on SECTION 230719 - HVAC PIPING

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. Installation conforms 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 that of adjoining pipe insulation.
  - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 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 GLASS-FIBER AND MINERAL WOOL 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 jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
  - 4. For insulation with 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 prefabricated 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 glass-fiber or mineral-wool 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 prefabricated sections of same material as that of 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 prefabricated sections of same material as that of straight segments of pipe insulation when available.
  - 2. When prefabricated sections are not available, install fabricated 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.

# 3.7 INSTALLATION OF FIELD-APPLIED JACKETS

- 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 PVC jackets are indicated and for horizontal applications, 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.
- C. 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 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.

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- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless steel jackets.

# 3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.
- B. 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.

### 3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation is the following:
    - a. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
  - 1. 1-1/4" and Smaller: Insulation is the following:
    - a. Glass-Fiber, Preformed Pipe, Type I: 1-1/2" thick.
  - 2. 1-1/2" and Larger: Insulation is the following:
    - Glass-Fiber, Preformed Pipe Insulation, Type I or Pipe and Tank Insulation:
       2 inches thick.

# 3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Exposed:
  - 1. PVC: 30 mils thick.

# **END OF SECTION 230719**

### SECTION 230800 - MECHANICAL SYSTEMS COMMISSIONING

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 WORK INCLUDED

- A. Systems and equipment testing and start-up.
- B. Validation of proper and thorough installation of Division 23 systems and equipment.
- C. Systems balancing verification.
- D. Prefunctional performance testing of equipment and systems.
- E. Documentation of tests, procedures, and installations.
- F. Coordination of Training Events.

#### 1.3 GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner's operational needs; that the installation is adequately documented; and that the operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols in an effort to advance the building systems from installation to full dynamic operation and optimization.
- B. Commissioning Authority (CxA) is retained by the Owner shall work with the contractor and the Design Engineer to direct and oversee the Cx process and perform functional performance testing.
- C. This Section outlines the Cx procedures specific to the Division 23 contractors. Requirements common to all Sections are specified in Sections 019113 and the Cx Plan.

### 1.4 SCOPE

- A. The following are included in the Scope of Commissioning on this project:
  - 1. HVAC
  - 2. Variable Speed Drives
  - 3. Boilers
  - 4. Hot Water system
  - 5. Hydronic Pumps
  - 6. Supply Fan
  - 7. Automatic Temperature Controls
  - 8. Testing, Adjusting and Balancing
  - 9. Carbon Monoxide Detection/Alarm Stations
  - 10. Misc. Systems (i.e. Unit Heaters etc.)

### 1.5 RELATED WORK AND DOCUMENTS

- A. Section 019113 General Commissioning Requirements: details the Cx requirements common across all divisions.
- B. Section 019114 Functional Performance Testing Procedures: Outlines the generic functional testing procedures required.
- C. Section 019115 Commissioning Plan including preliminary Pre-Functional and Functional Performance Testing Procedures: Outlines the initial Commissioning Plan including pre-functional and functional testing procedures required.
- D. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.

# 1.6 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019113.

# 1.7 REFERENCE STANDARDS

- A. ASHRAE Guideline 0-2013, "The Commissioning Process"
- B. ASHRAE Guideline 4-2008 Edition, "Preparation of Operating and Maintenance Documentation for Building Systems"
- C. NEBB Procedure Standards for Building Systems Commissioning

### 1.8 DOCUMENTATION

- A. In addition to the documentation required in Section 019113, Contractor shall provide to the CxA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specification:
  - 1. Balancing Plan: The plan shall include the following:
    - a. Certification documents, within the last 6 months, on all instrumentation to be used throughout the testing.
    - b. Résumés and Certification of individuals who will be balancing systems.
    - c. Detailed step by step plans for each procedure to be performed.
    - d. Sample forms to be used for each measurement.
    - e. Sample balancing report.
  - 2. Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports should be provided in pdf electronic format. These may include but are not limited to:
    - a. Variable Frequency Drives
    - b. Fans Capacity
    - c. Boiler system
  - 3. Field Testing Agency Reports (other than TAB): Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports should be provided in pdf electronic format. These may include but are not limited to:
    - a. Pipe Pressure Testing
    - b. Duct Leakage Testing
  - 4. Completed Test and Balance Reports. CxA will review prior to FPT.

### 1.9 SEQUENCING AND SCHEDULING

- A. Refer Section 019113
- B. Coordination Management Protocols
  - Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019113 and the 019115 Commissioning Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off meeting. Contractor shall have input in the protocols and all parties will commit to scheduling obligations. The CxA will record and distribute.

# 1.10 CONTRACTOR RESPONSIBILITIES

A. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in Section 019113. The following are additional responsibilities or notable responsibilities specific to Division 23. If the CxA/Engineer/Owner must get involved with coordinating between the TAB Contractor, BAS Contractor and Mechanical Contractor due to lack of cooperation for phasing or execution of work then each contractor shall be responsible for all the CxA/Engineers/Owner's time and expenses for those efforts.

### B. Construction Phase

- 1. Provide skilled technicians qualified to perform the work required.
- 2. Provide factory-trained and authorized technicians where required by the Contract Documents.
- 3. Prepare and submit required draft Start-Up Procedures and submit along with the manufacturer's application, installation and start-up information.
- 4. Assist the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
- 5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere in this Section.
- 6. Start-up, and Test/Adjust/Balance systems and equipment prior to functional performance testing by the CxA. Start-Up Procedures shall be in accordance with Contract Documents, reference or industry standards, and specifically elsewhere in Part I of this Section.
- 7. Record Start-up Procedures on start-up procedure forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above and in Section 019113. Each task or item shall be indicated with the Party performing the task or procedure.

# C. Acceptance Phase

1. Assist CxA in functional performance testing as needed

# D. Warranty Phase

- 1. Maintain record documentation of any configurations, set ups, parameters etc., that change throughout the period.
- 2. Provide representative for off season testing as required by CxA.
- 3. Respond to Warranty issues as required by Division 1 and the General Conditions.

# 1.11 EQUIPMENT SUPPLIER RESPONSIBILITIES

A. Refer to Section 019113.

### 1.12 CONTRACTOR NOTIFICATION AND SCHEDULING

A. Refer to Section 019113.

# 1.13 START-UP PROCEDURES AND DOCUMENTATION

A. Refer to Section 019113.

### 1.14 FUNCTIONAL PERFORMANCE TESTING

A. Contractor shall participate in the support of Functional Performance Testing as stipulated in Section 019114 and appendix A in Section 019115.

# 1.15 TRAINING

A. Contractors, Subcontractors, Vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019113 and the individual Specifications.

### 1.16 O&M MANUAL CONTENT - PREPARATION AND LOGISTICS

A. Refer to Section 019113 and the individual Specifications.

### PART 2 - PRODUCTS

### 2.1 INSTRUMENTATION

- A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:
  - 1. Temperature sensors and digital thermometers shall have a certified calibration within the past year and a resolution of + or 0.1F.
  - 2. Pressure sensors shall have an accuracy of + or 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year.
  - 3. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.
- B. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

# 2.2 WEB-BASED COMMUNICATION PORTAL

A. All general and major subcontractors participating in the Cx process shall use the webbased Cx Portal ('Portal') to document the Cx procedures (where used on the Project). The Portal is a Web-based Internet hub used to electronically collaborate and coordinate activities and deliverables throughout the Cx process. The Portal is hosted by the CxA and shall be accessible to all Parties participating in the Cx program. The Portal provides a common location to store Start-Up Documentation, Functional Performance Tests and results, project documents and deliverables. It also serves as a collaborative email hub to facilitate, automate, and track communications between Parties relating to the Cx process.

B. Refer to Section 019113 and individual Specifications for additional information and requirements for using the Portal.

### PART 3 - EXECUTION

# 3.1 START-UP PROCEDURES - GENERAL

A. Please refer to the Commissioning Plan for preliminary copies of the pre-functional check lists and start-up tests for the various systems. These check lists outline 'generic' or minimally acceptable Start-Up Procedures (delineated as Start-Up Checks and Start-Up Tests) and individual systems Training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per normal quality control practices. These items shall provide a minimum or guideline for required Contractor development of Start-Up Procedures. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized Start-Up Procedures specific to the equipment and systems installed on this project.

### 3.2 PROCEDURES COMMON TO ALL SYSTEMS

- A. The following start up verifications/procedures are common to all systems
  - 1. Checkout shall proceed from devices to the components to the systems.
  - 2. Verify labeling is affixed per spec and visible
  - 3. Verify prerequisite procedures are done.
  - 4. Inspect for damage and ensure none is present.
  - 5. Verify system is applied per the manufacturer's recommendations.
  - 6. Verify system has been start up per the manufacturer's recommendations.
  - 7. Verify that access is provided for inspection, operation and repair.
  - 8. Verify that access is provided for replacement of the equipment.
  - 9. Verify the record drawings, submittal data and O&M documentation accurately reflect the installed systems.
  - 10. Verify all gages and test ports are provided as required by contract documents and manufacturer's recommendations.
  - 11. Verify all recorded nameplate data is accurate.
  - 12. Installation is done to ensure safe operation and maintenance.
  - 13. Verify specified replacement material/attic stock has been provided as required by the Construction Documents.
  - 14. Verify all rotating parts are properly lubricated.
  - 15. Verify all monitoring and ensure all alarms are active and set per Owner's requirements.

### 3.3 BUILDING AUTOMATION AND CONTROL SYSTEMS

- A. Work and/or systems installed shall be fully functioning prior to Acceptance Phase. Contractor shall start, test, adjust, and calibrate all work and/or systems under this Contract.
  - 1. Inspect the installation of all devices. Review the manufacturer's installation instructions and validate that the device is installed in accordance with them.
  - 2. Verify proper electrical voltages and amperages, and verify that all circuits are free from faults.
  - 3. Verify integrity/safety of all electrical connections.
  - 4. For the following control settings, initially use the control setting that was used by existing control system, unless otherwise indicated. For AHUs that use a throttled outside air damper position when minimum outside air is required, contractor shall mark existing minimum outside air damper position to allow replication by new controls.
  - 5. Coordinate with TAB subcontractor to obtain control settings that are determined from balancing procedures. Record the following control settings as obtained from TAB contractor, and note any TAB deficiencies:
  - 6. Test, calibrate, and set all digital and analog sensing and actuating devices. Calibrate each instrumentation device by making a comparison between the ATC display and the reading at the device, using an instrument traceable to the National Bureau of Standards, which shall be at least twice as accurate as the device to be calibrated (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the FMS Start Up Report.
  - 7. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control loop.
- B. BAS Contractor shall provide an additional 25 CxA/Engineer/Owner requested, customized graphic modifications with dynamic point information. Coordinate type and points required with CxA/Engineer/Owner prior to installation and closeout. These requested graphic modifications are in addition to the five custom graphic screens required in Section 230993.
- C. BAS Contractor shall provide all necessary software licenses for web-based access for at least 4 stations. Provide software/read only (or higher access when requested by CxA) with appropriate secure password access to CxA for their use during startup/warranty. Provide all necessary support for installation of software on CxA's computers of their choice or provide notebook computers with software preloaded with wi-fi for internet access for use through the construction/warranty period. Provide CxA full read and partial write access to DDC controls by installing all software, licensing, password access for read/partial write access including viewing all graphics on the CxA's computers of their choice.
- D. The BAS Contractor shall spend as much time as required to provide a fully functional, debugged system that meets the requirements of the CxA/Owner/Engineer. Controls Contractor shall fully cooperate with the TAB Contractor and all other contractors to provide complete commissioning of all building systems and equipment in accordance with Division 01, and 23 specifications.

E. The BAS Contractor shall demonstrate the operation of the control system to the satisfaction of the CxA, Owner, Engineer, and Owner's Representative. Schedule demonstration with all parties to be involved a minimum of two (2) weeks in advance. The control system demonstration and training shall not be scheduled until all hardware and software has been reviewed by the CxA/TAB Contractor/Engineer/Owner's Representative and their report of completion/findings has been accepted by the Engineer/TAB Contractor/Owner's Representative. If the work fails to be demonstrated to conform with contract documents, requiring additional site visits by the CxA, Engineer and/or TAB Contractor/Owner's Representative for re-demonstration, the BAS Contractor shall reimburse for all direct and indirect costs of subsequent site visits.

# F. Trend Logs

- 1. Trends are historical archives on computer disks that document the operation of the systems and equipment. Trends can be interval recordings of system I/O parameters or Change of Value based trends that record when a system value changes by more than a specified threshold.
- 2. CxA will analyze trend logs of the system operating parameters to evaluate normal system functionality. The requirements of the trending are specified below. Contractor shall establish these trends, ensure they are being stored properly, and forward the data in electronic format to the CxA.
- 3. Data shall include a single row of field headings and the data thereafter shall be contiguous. Each record shall include a date and time field. Recorded parameters for a given piece of equipment or component shall be trended at the same intervals and be presented in a maximum of two separate two-dimensional formats with time being the vertical axis and field name being the horizontal axis. Data shall be forwarded in electronic formats to the CxA.
- 4. Sample times indicated as COV (±) or change of value mean that the changed parameter only needs to be recorded after the value changes by the amount listed. When output to the trending file, the latest recorded value shall be listed with any given time increment. If the FMS does not have the capability to record based on COV, the parameter shall be recorded based on the interval common to the unit.
- 5. Contractor shall provide the CxA with required passwords, phone numbers, etc. to allow the CxA access to the trend log data and allow downloading to a remote location. Contractor shall also provide step-by-step written instructions for accessing the data.

# G. Trend Graphs

- Trend graphs shall generally be used during the Acceptance Phase to facilitate and document testing. Prepare controller and workstation software to display graphical format trends during the Acceptance Period. Trend graphs shall demonstrate compliance with contract documents. Trended values and intervals shall be the same as those specified for the functional performance tests.
- 2. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.
- 3. Indicate engineering units of the y-axis values; e.g. degrees F., inches w.g., Btu/lb, percent wide open, etc.
- 4. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.

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- 5. Trend outside air temperature, humidity, enthalpy, and BAS points associated with boilers during each period in which any other points are trended.
- 6. All points trended for one HVAC subsystem (e.g. Boilers and associated BAS points.) shall be trended during the same trend period.
- 7. Each graph shall be clearly labeled with HVAC subsystem title, date, and times.

# 3.4 WARRANTY PHASE AND OPPOSITE SEASON TRENDING AND TESTING

A. Trending: Throughout the Warranty Phase, trend logs shall be maintained as required for the Acceptance Period. Contractor shall forward archived trend logs to the CxA for review upon CxA's request. CxA will review these and notify contractor of any warranty work required.

**END OF SECTION 230800** 

### SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:
  - 1. Division 23 Section "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

# 1.3 SCOPE OF WORK

Α. Prior to demolition, the ATC shall field verify and identify which existing control devices, wiring, etc. are to remain for reuse. Demolition activities shall be done carefully during the phased construction, so the HVAC system operations impacting use of the building are minimally impacted. The construction is scheduled to be phased with construction occurring while the facility is being used and the Controls Contractor shall be fully responsible to keep the existing controls system functioning until all devices/controls have been replaced for new work and the existing HVAC systems that remain function properly. Controls Contractor shall modify controls systems as required to keep the systems operational and include all costs in bids. Controls contractor shall provide an extension of the existing Building Automation System (BAS) to control all mechanical equipment associated within this project. All new building controllers, and equipment/plant controllers, shall be tied into the existing Trane Tracer Ensemble. The Mechancial Contractor and Controls Contractor shall fully coordinate to minimize disruption of proper control of existing and new systems. If the Engineer/Owner must get involved with coordinating between the Controls Contractor and Mechanical Contractor due to lack of cooperation for phasing or execution of work, then both contractors shall be responsible for all the Engineers/Owner's time and expenses for those efforts.

- B. New controls provided by controls contractor shall be tied into Owner's existing Trane Ensemble System for seamless user interface. Hotlinks/Targets to other applications and/or separate web pages will NOT be accepted as a seamless interface to the Ensemble System.
- C. Controls contractor shall provide long-term data logging and archiving of data, for a minimum of (3) years.
- D. The Building Automation System shall be as indicated on the drawings and described in these specifications. System must be fully integrated and coordinated with mechanical equipment DDC controllers furnished and installed in the equipment manufacturer's factory as specified in those sections. The intent of the BAS is to tie all mechanical equipment into one system for global monitoring, control, and alarming associated with the building. It is the BAS manufacturer's responsibility to provide all the design, engineering, and field coordination required to ensure all equipment sequence of operations are met as specified and the designated BAS operators have the capability of managing the building mechanical system to ensure occupant comfort while maintaining energy efficiency. The BAS shall meet open standard protocol communications standards (As defined in System Communications and Field Bus Communications of COMMUNICATIONS) to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects. Direct Digital Control (DD) system shall be used to provide the functions necessary for control/monitor of systems on this project.
- E. Controls Wiring for leak detection systems: The temperature controls contractor shall provide the DDC controls interface between systems including, but not limited to, leak detection system and BAS. The Controls Contractor shall review all control components furnished with the equipment and provide all the additional necessary wiring and components to provide a complete and working DDC controls system with leak detection system.
- F. Controls for Boiler Systems. The Temperature Controls Contractor shall provide the DDC controls interface between systems including, but not limited to, boilers, boiler pumps, flow meters, and the BAS. The Controls Contractor shall review all control components furnished with the equipment and provide all the additional necessary components to provide a complete and working DDC controls system. Controls Contractor shall field install DDC controller and control devices on all terminal units. ATC shall be fully responsible for coordinating all necessary control points with existing Boilers mfr., and other equipment for a complete and operational system. ATC shall provide documentation from Boiler manufacturer that shows the control drawings have been fully coordinated. Any existing control device to be reused for the new work shall still meet all the requirements of the contract drawings and specifications including the 2 year service and warranty. The Temperature Controls Contractor shall provide the DDC controls interface between systems including, but not limited to,
- G. Controls Wiring for Indoor Systems: The temperature controls contractor shall provide all 24V controls wiring required by boiler systems manufacturer and coordinate BACNet IP/Modbus interface with these Systems for integration into the DDC controls system. Coordinate final requirements with these manufacturers prior to bidding and include all

- costs in base bid by providing all required control components to provide a complete and working integrated DDC control system.
- H. Controls for supply fan and damper actuators: The Temperature Controls Contractor shall provide the DDC controls interface between the supply fan, damper actuators for intake and relief louvers and the BAS. The Controls Contractor shall review all control components furnished with the equipment and provide all the additional necessary components to provide a complete and working DDC controls system. Controls Contractor shall field install DDC controller and control devices.
- I. Controls Contractor shall field install DDC Controller in locations approved by Owner/Engineer. Controls Contractor shall relocate DDC controllers at no additional cost if they are installed in any location not acceptable to the Engineer or Owner.
- J. Controls contractor shall reuse existing controls wiring, conduit, accessories and devices as much as possible unless noted otherwise for existing to remain equipment.
- K. Controls contractor shall field verify if the existing sensors, control accessories and devices are compatible with new control system. Controls contractor shall install new sensors and devices if existing are not compatible with new control system.
- L. Temperature control wiring and conduit (unless otherwise indicated on the drawings and Control sections of specifications) shall be the responsibility of the Controls Contractor. All wiring and conduit, including power wiring, required for the automatic temperature control system to be fully functional shall be the responsibility of the Controls Contractor, and all costs shall be included in their proposal.
- M. The Controls Contractor shall engage an Electrical Contractor to provide all power wiring, conduit and boxes required for the automatic temperature control system to be fully operational. Power wiring associated with the automatic temperature control system indicated on the electrical drawings is considered part of the Electrical Contractors scope of work and shall be included in their proposal. All cost for additional power wiring not indicated on drawings and required for DDC controls shall be included as part of the Controls Contractors proposal.
- N. Control system work required by this section is indicated on drawings and schedules, and by the requirements of this section. The control system consists of all required components including but not limited to sensors, instruments, valves, actuators, indicators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multitasking, multi-user environment on network and programmed to operate mechanical systems according to sequences of operations indicated or specified and service for a complete and functional DDC control system. Control system shall be designed to allow easy field adjustment of all set points and parameters.
- O. Controls contractor is responsible for coordinating the tie-in to the fire alarm system in regard to shut down of HVAC equipment during alarm conditions. Any line voltage wiring necessary for this work shall be by Controls Contractor.
- P. All DDC devices including field sensors shall be mounted in a control panel or appropriate NEMA rated housing. All control panels shall be mounted in mechanical

rooms or service corridors where the equipment being controlled is located or in locations approved by Owner and Engineer. Mount panels on wall, columns, or independent supports near each respective unit. Do not mount on the unit proper unless approved by Engineer/Owner and unit manufacturer. Panels shall have back plates for mounting all transducers, relays, gauges, etc.

- Q. Tags All control devices shall be tagged. Tags for DDC devices that are part of the control board may be laminated plastic with sticky back. All other tags must be pre-drilled and screwed on the back plate of the control panel. No label gun tags will be accepted. Tags shall be white lettering on black background.
- R. The Controls Contractor shall interface with supply fan and damper for mechanical room ventilation control/monitoring, etc. schedule/control as required. See Division 23 Sequence of Operations for HVAC Controls for additional information.
- S. The Controls Contractor shall interface with the new boilers controls system for integration and remote monitoring /control of systems. This shall include all software and hardware as required.
- T. Graphics with dynamic point information for all controlled equipment including each fan, heating, system shall be provided. Information shall be displayed in a user-friendly, easy to understand format utilizing graphical components.
- U. Contractor shall provide an additional 25 Engineer/Owner requested, customized graphics with dynamic point information. Coordinate type and points required with Engineer/Owner prior to installation and closeout.
- V. Provide all necessary software licenses for web-based access for at least 4 stations and provide software/read only password access to Engineer for their use during startup/warranty. Provide all necessary support for installation of software on Engineer's computers of their choice and provide notebook computer with software preloaded with wi-fi for internet access for use through the construction/warranty period. Provide Engineer full read access to DDC controls by installing all software licensing, password access for read only access including viewing all graphics on the Engineer's computers of their choice.
- W. All controllers shall be able to function even with loss of network communication. Controls Contractor shall use controllers that will permit operation of HVAC systems so systems will remain operational.

### 1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
  - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
  - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
  - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.

- 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
- 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
- 6. Program Execution Frequency: Run capability of applications as often as five seconds but selected consistent with mechanical process under control.
- 7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
- 8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
  - a. Space Temperature: Plus or minus 0.5 F.
  - b. Ducted Air Temperature: Plus or minus 0.5 F.
  - c. Outside Air Temperature: Plus or minus 0.5 F.
  - d. Dew Point Temperature: Plus or minus 0.25 F.
  - e. Temperature Differential: Plus or minus 0.25 F.
  - f. Relative Humidity: Plus or minus 2 percent.
  - g. Carbon Monoxide: Plus or minus 20% of reading between 0-100 ppm.
  - h. Electrical: Plus or minus 3 percent of reading.

# 1.5 SUBMITTALS

- A. If Submittals are rejected twice then the Submitting Contractor's application for payment shall be reduced by \$3,500, or the Engineer's time and material cost, whichever is greater, to pay the Engineer for his service before the re-submittal is reviewed. No time extension will be granted for project completion resulting from the submittals being rejected. In addition, for each re-submittal thereafter the Submitting Contractor's application for payment shall be reduced by the amounts stipulated above.
- B. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
- C. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
- D. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
- E. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- F. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- G. Bill of materials of equipment indicating quantity, manufacturer, and model number.

- H. Schematic flow diagrams showing hydronic systems, boilers, supply fan, pumps, dampers, valves, and control devices, etc.
- I. Documents showing Controls Contractor has completed coordination between new boiler manufacturer/supplier a for control interface so all required work is included between the Controls Contractor and boiler manufacturer/supplier furnished controls has been included for a complete and operational system. If the coordination documents are not included within the submittals, it can be cause for rejection of submittals.
- J. Wiring Diagrams: Power, signal, and control wiring.
- K. Details of control panel faces, including controls, instruments, and labeling.
- L. Schedule of dampers including size, leakage, and flow characteristics.
- M. Schedule of valves including flow characteristics.
- N. DDC System Hardware:
  - 1. Wiring diagrams for control units with termination numbers.
  - 2. Schematic diagrams and floor plans for field sensors and control hardware.
  - 3. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  - 4. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
  - 5. Controlled Systems:
    - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction for panels.
    - c. Written description of sequence of operation including schematic diagram points list.
- O. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135 where required for integration with systems and certain other specific HVAC devices.
- P. Software and Firmware Operational Documentation: Include the following:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.
  - 5. Software license required by and installed for DDC workstations and control systems.
  - 6. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
  - 7. Field quality-control test reports.

- Q. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals in addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Maintenance instructions and lists of spare parts for each type of control device.
  - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
  - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  - 5. Calibration records and list of set points. Manuals shall contain the final list of all points and their programmed values for future use in commissioning the systems

### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer specializing in control system installations. Trained employees of manufacturer's local office or authorized installation and service organization shall perform the installation. Applications engineer in the employ of the manufacturer or authorized installation and service organization shall supervise the control system design and installation.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing control systems similar to those indicated for this Project and that have a record of successful in-service performance for not less than five (5) years.
- C. Startup Personnel Qualifications: Engage specially trained personnel that have been certified in all aspects of the software, hardware, installation, programming, startup, and calibration of primary temperature microprocessor control system.
- D. Comply with NFPA 90A and NFPA 70.
- E. Coordinate equipment selection with "Fire Alarm Systems" to achieve compatibility with equipment that interfaces with that system.
- F. The equipment and software proposed by the supplier shall be currently in manufacture. No custom products shall be allowed unless required by the specifications and approved by the Owner. All products shall be supported by the manufacturer for a minimum of five (5) years, including spare parts, board repairs, and software revisions.

### 1.7 CODES AND STANDARDS

- A. Electrical Standards: provide electrical products, which have been tested, listed, and labeled by UL and comply with NEMA standards.
- B. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electrical control systems.

C. NFPA Compliance: Comply with NFPA 90A "Standard for the installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequence.

# 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.
- C. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from the weather.
- D. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

# 1.9 COORDINATION

- A. Coordinate location of thermostats, and other exposed control sensors with plans, room details and Owner prior to installation.
- B. Coordinate equipment with Division 28 Section "Fire Detection and Alarm" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- D. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.

#### 1.10 EXTRA MATERIALS

- A. Control Contractor shall coordinate extra material requirements with the Owner and provide material agreed to be included as part of the Control Contractor's contract.
- B. Replacement Materials: Provide one replacement for each unique damper motor, valve motor, controller, and thermostat. Replacement applications shall be clearly labeled for each unique item (i.e. "AHU Controller").

# PART 2 - PRODUCTS (MERCURY IS NOT PERMITTED IN ANY COMPONENT)

# 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide the following:
  - 1. BASE BID BASIS OF DESIGN extending the existing facilities Building Automation Trane Controls system.
- B. Alternate manufacturers may be considered; however, alternate manufacturers shall be responsible to replace ALL existing building DDC controls, so the facilities have the same manufacturer and shall field verify the extent of existing controls prior to bid to include all costs in bid.

### 2.2 CONTROL SYSTEM

A. Base Bid Trane Control system installed under this project must be configured to seamlessly integrate with the existing building and campus Trane control system. This includes seamless integration of the existing facilities on the campus via Owner furnished dedicated IP addresses. Control Contractor shall be fully responsible to coordinate quantity of dedicated IP addresses directly with the Owner and include all costs associated with coordination. Alternate manufacturers shall provide a web-based system that encompasses the project as defined by these documents.

# B. System communications:

- Each workstation, building controller, and equipment controller communication interface shall utilize the BACnet protocol with an Ethernet (IEEE 802.3, 802.11), RS485 (EIA-485), or Zigbee (802.15.4) physical interface and an appropriate data link technology as defined in ANSMAKIRAE® Standard 135-2012. (e.g. BACnet over IP, BACnet over IPv6, BACnet over MS/TP, BACnet Zigbee.
- 2. All system controllers shall be BTL listed as a BACnet Building Controller (B-BC) as defined in ANSMASHRAE® Standard 135-2012. All documented status and control points, schedule, alarm, and data-log services or objects shall be available as standard object types as defined in ANSMASHRAE® Standard 135-2012.
- 3. Each System Controller shall communicate with a network of Custom Application and Application Specific Controllers utilizing one or more of the interfaces documented within Field Bus Communications below.

# C. Field Bus Communications (BACnet):

- 1. All equipment and plant controllers shall be BTL listed as a BACnet Application Specific Controller (B-ASC) or a BACnet Advanced Application Controller (B-AAC) as defined in ANSI®/ASHRAE® Standard 135-2012.
- 2. All communication shall conform to ANSMASHRAE' Standard 1352012.
- System Controller shall function as a BACnet router to each unit controller providing a globally unique BACnet Device ID for all BACnet controllers within the system.

- 4. BACnet over Zigbee: Communication between System Controller and equipment/plant controllers shall utilize BACnet over Zigbee as defined in ANSI®/ASHRAE® Standard 135-2012.
- 5. BACnet over MS/TP: Communication between System Controller and equipment/plant controllers shall utilize BACnet over MS/TP as defined in ANSI®/ASHRAE® Standard 135-2012.
- 6. Each equipment controller wireless communication interface shall self-heal to maintain operation in the event of network communication failure.
- 7. Each sensor wireless communication interface shall be capable of many-to-one sensors per controller to support averaging and monitoring. Sensing options shall include temperature.
- D. Alternate manufacturers shall provide dedicated web-server PC (see specifications herein) to incorporate the scope of this project and be expandable to areas not covered in this project, including to other facilities within the capitol campus. This includes specified hardware, software, and software site licenses as required. Alternate manufacturers shall replace existing Trane controllers as required with new controllers, so the facility's controls are the same throughout the building.
- E. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.
- F. Controllers shall be stand alone and maintain operation of the equipment even if the facilities internet system is disrupted using the building local area network. Provide UPS base as required to maintain schedules and sequences of operation in the event of a power interruption and resuming of normal power. Controls Contractor shall be responsible to field verify any existing DDC controls reused and make all necessary changes to meet these criteria and include costs in bid.
- G. All listed manufacturers shall meet all the requirements of this specification.
- H. Operating Environment: All System Controllers (SC's) and Terminal Controllers (TC's) shall operate in an environment of -40° to 140°F and 5 per cent to 95 per cent relative humidity, non-condensing when located in areas subject to extreme temperatures.
- I. Agency Approvals: All controllers shall be UL approved as an Energy Management System (UL 916) and shall also comply with FCC regulations.
- J. The equipment manufacturer or supplier shall provide 24-hour a day, seven day a week service coverage for all equipment with either a local or 800 emergency phone numbers. Equipment shall have a minimum one (1) year parts and labor warranty.
- K. The equipment manufacturer or supplier shall provide 24-hour a day, seven day a week service coverage for all equipment with either a local or 800 emergency phone numbers. Equipment shall have a minimum one (1) year parts and labor warranty.
- L. Operating Environment: All System Controllers (SC's) and Terminal Controllers (TC's) shall operate in an environment of -40° to 140°F and 5 per cent to 95 per cent relative humidity, non-condensing when located in areas subject to extreme temperatures.

- M. Agency Approvals: All controllers shall be UL approved as an Energy Management System (UL 916) and shall also comply with FCC regulations.
- N. The equipment manufacturer or supplier shall provide 24-hour a day, seven day a week service coverage for all equipment with either a local or 800 emergency phone numbers. Equipment shall have a minimum one (1) year parts and labor warranty.
- O. The equipment manufacturer or supplier shall provide 24-hour a day, seven day a week service coverage for all equipment with either a local or 800 emergency phone numbers. Equipment shall have a minimum one (1) year parts and labor warranty.

# 2.3 GENERAL

- A. Furnish all control components and accessories required to accomplish the sequence of operation as per Division 23 section "Sequence of Operations for HVAC Controls".
- B. The Microprocessor based controllers shall monitor the data environment and perform control functions in relation to a programmed strategy and the status of the environment.
- C. All control wiring concealed in walls and exposed in mechanical rooms, closets, etc., shall be in conduit. In the existing building, surface mount wiremold is acceptable where conduit cannot be installed in the block wall. Architect shall select color of wiremold. Provide plenum rated wiring where cable is concealed above ceilings. Do not paint wiring. The Contractor is responsible for protecting wiring from paint. Any painted cabling shall be replaced
- D. ATC shall also refer to the mechanical maintenance, HVAC equipment, and all other sections of the specifications for additional control requirements.
- E. The system shall use solid-state computer based digital and analog technology. The system shall be standard with the manufacturer to ensure ongoing parts availability and trained technical support.
- F. The Microprocessor controller shall be of the fully user programmable type requiring no special computer education for operation. All Owners training shall be by the manufacturer or agent thereof.
- G. The Controls Contractor shall fully coordinate with Balancing Contractor.
- H. Controls shall be field-installed or factory-installed.
- I. All materials used shall be approved for use in return air plenums where applicable.

# 2.4 STATUS SENSORS

A. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current and rated for 150°C

- B. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- C. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements and rated for 150°C.

#### 2.5 SYSTEM SOFTWARE

- A. Description: This section describes the software capabilities for the entire system, inclusive of the controller software for both controllers.
- B. Workstation: Install updated software package to integrate the new controls for Campus wide controls. Coordinate web-based interface with Owner. Web browser required for 4 (minimum) simultaneous clients.
- C. Controller Software: The application software shall be configured for each controller either locally through a laptop service tool or through a workstation. Controllers shall contain PROM as the resident operating system. Application software will be RAM resident. Application software will be limited only by the amount of RAM memory. There will be no restrictions placed on the type of application programs in the system.
- D. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function by controllers shall not be interrupted due to normal use communications including interrogation, program entry, printout of the program for storage, etc. All programming shall be on-line and not require system shutdown.
- E. The Real-Time Operating System shall provide a real-time operating system in PROM memory requiring no operator interaction to initiate and commence operation. The program shall include operation and management of all devices, error detection and recovery from arithmetic and logical faults, editing software to allow the user to develop or alter application programs, system self-testing, multi-user, and multi-tasking.
- F. When programming a controller through either a front-end terminal or laptop computer, editing and word processing features will include as a minimum:
  - 1. Cut, copy, paste, and undo
  - 2. Search and replace
  - 3. Comments
  - 4. Scrolling
  - 5. Character, line, and page cursor control
- G. When programming in terminal mode, the system will allow full screen character editing for correction or modification of any portion of a program. Syntax errors will be highlighted, and programmers must make corrections prior to the program being compiled.
- H. Controllers shall have automatic uploading and downloading capability of the compiled code to the controller.

- I. Point Identification: Users must be able to assign unique identifiers for each connected point. Identifiers must have at least sixteen (16) alphanumeric characters. All references to these points in programs, reports, and command messages shall be by these identifiers. Each point name can have up to a 32-character description, and optionally engineering units (up to 8 characters).
- J. Application Software: The systems shall contain software modules for the creation of standard application programs. Modules will include as a minimum PID algorithm, self-tuning PID, calendar functions (seconds, minutes, hour, day of week, day of month, day of year, month, and year), curve fit, and optimum start.
- K. Mathematical Functions: Each controller shall be capable of performing basic mathematical functions (+, -, X. /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive of, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.
- L. History Logging: Each controller shall be capable of logging any system variable over user defined time intervals ranging from one second to 365 days. Any system variables (inputs, outputs, math calculations, flags, etc.) can be logged in history. A maximum of 32,767 values can be stored in each log. Each log can record the instantaneous, average, minimum, or maximum value of the point. Logs can be automatic or manual. It shall be possible to find the average of a log, the standard deviation, the sum, minimum, or maximum. It shall also be possible to reference any value within a log for use in a control program.
- M. Reporting: The system shall be able to create user definable reports containing any combination of text and system variables. Report templates shall be able to be created by users in a word processing environment. Reports can be displayed based on any logical condition or through a user command. Numerical displays shall be up to 8 digits in total length, with up to 8 digits to the right of the decimal point. The format of each numerical display shall be user definable.
- N. Alarming: For each system point alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan and can result in the display of one or more alarm messages or reports. Messages and reports can be sent to the optional display panel, a local terminal, to the host workstation, or via modem to a remote computing device.
- O. Override Programs: It shall be possible to disable any point in the system and modify it to a user definable value. Any points that have been disabled will be kept in a log and viewable by an operator at any time.
- P. GUI Server Application Software: Include the following:
  - Input/output capability from operator station for monitoring and controlling all of the points listed in the input/output point list. The operator shall be able to monitor and access all points by means of clear concise English names without having to understand or reference hardware point locations or controller programs.

- 2. Operating System: The GUI shall run on Microsoft Windows 10 Professional, or later.
- 3. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands, and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
- 4. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
  - a. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
  - b. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URLs, and links to other graphic screens.
  - c. Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.
  - d. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
    - 1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    - 2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
  - e. Commands to start and stop binary objects shall be done by right clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
  - f. Adjustments to analog objects, such as set points, shall be done by right clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.
  - g. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
    - 1) Create, delete, or modify control strategies.
    - 2) Add/delete objects to the system.
    - 3) Tune control loops through the adjustment of control loop parameters.
    - 4) Enable or disable control strategies.
    - 5) Generate hard copy records or control strategies on a printer.
    - 6) Select points to be alarmable and define the alarm state.
    - 7) Select points to be trended over a period of time and initiate the recording of values automatically.
  - h. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the

- use of hypertext. All system documentation and help files shall be in HTML format.
- i. Security. Each operator shall be required to log on to that system with a username and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and a minimum of 5 different security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
- j. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
- k. Alarm Console. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

### 2.6 DDC EQUIPMENT

### A. General

- 1. All hardware provided shall include a one (2) year base bid product warranty, beginning from the date of substantial completion.
- 2. All materials used shall be approved for use in return air plenums where applicable.

### B. Web Browser Clients

- 1. The system shall be capable of supporting a minimum of 4 clients using a standard Web browser such as Internet Explorer™, Firefox™, or Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, are only acceptable if 64 licensed copies of the client machine software are provided, installed, and tested.
- 2. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BAS, shall only be acceptable if a minimum of 4 workstations or workstation hardware upgrades are provided.
- 3. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views

or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

- 4. The Web browser client shall support at a minimum, the following functions:
  - a. User log-on identification and password shall be required. If unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
  - b. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
  - c. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
  - d. Storage of the graphical screens shall be on the front -end workstation system, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
  - e. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
  - f. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
- 5. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
  - a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
  - b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    - Commands to start and stop binary objects shall be done by clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    - 2) View logs and charts
    - 3) View and acknowledge alarms
  - c. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator. The web-based building automation systems shall be accessible from workstations at Owner's remote site(s). Once logged in only information for that area shall be accessible and adjustable. System shall display current temperature and temperature set point information. All other building automation system information shall be inaccessible.
  - d. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

# C. Networks and Operator Communications

- 1. General: The network architecture shall consist of one (1) level. The network shall be a high-speed LAN designed to support network controllers, central plant controllers, and a Graphics Workstation.
- 2. High Speed LAN: This local area network shall operate at a minimum speed of 100 mb or 1000 mb utilizing a deterministic Ethernet communications architecture. The

high-speed LAN will provide transfer of point data, alarms, and file activity among Level 1 controllers, workstations, and the file server. The high-speed LAN shall support a minimum of 64 nodes consisting of Level 1 controllers or workstations.

- a. The Ethernet connections shall be switch-selectable between 10 base T, 10 base 2, and AUI (10 base 5 T).
- b. Any data from a Level 2 controller can also be transmitted onto this bus through a Level 1 controller. The high-speed LAN shall support multi-communications and multi-session activity. That is, all global data sharing shall occur simultaneously with the transmission of alarm data or user activity.
  - Network Transparency: All points contained on the controllers shall be considered global points. Any program in any controller on the network shall be able to reference any point in any controller regardless of its location on the network.
  - 2) The system bus shall permit peer-to-peer communications among all controllers and allow simultaneous communications with laptop computers that are connected to a controller. Failure of the front-end computer controller will not impair the operation of its associated system bus.
  - Workstation Communications: The workstation shall be connected directly to the network controller through an Ethernet communications port or USB interface. The workstations shall be able to communicate to any controller. The workstations shall also be able to communicate via network to remote controllers. Telephone communications shall operate simultaneously with communication to any controllers connected on the high-speed LAN.
  - 4) Remote Access Communications: It shall be possible to access the network remotely through the internet. This remote access shall permit direct access to the system bus.
- D. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
  - 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
    - d. Software applications, scheduling, and alarm processing.
    - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
  - 3. Standard Application Programs:
    - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short cycling, PID control, DDC with fine tuning, and trend logging.

- b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
- c. Boiler Control Programs: Control function of boilers and equipment sequencing.
- d. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
- e. Remote communications.
- f. Maintenance management.
- g. Units of Measure: Inch-pound.
- 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
- E. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
  - 1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
  - 3. Standard Application Programs:
    - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control, with differential sequencing, staggered start, anti-short cycling, PID control, DDC with fine tuning, and trend logging.
    - b. HVAC Control Programs: Optimal run-time, supply-air reset, and enthalpy switchover.
    - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
    - d. Remote communications.
    - e. Maintenance management
    - f. Units of Measure: Inch-pound.
  - 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
- F. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
  - 1. Digital Inputs (DI): Allow monitoring of on-off signals without external power.
  - 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  - 3. Analog Inputs (AI): Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  - 4. Digital Outputs (DO): Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.

- 5. Analog Outputs (AO): Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
- 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
- 7. Universal I/Os: Provide software selectable binary or analog outputs.
- 8. All controllers and control panels shall have a minimum of 10% spare input and output points (minimum 1 spare input and one spare output if total is less than 10 each)
- G. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
  - 1. Output ripple of 5.0 mV maximum peak to peak.
  - 2. Combined 1 percent line and load regulation with 100-milisec. response time for 50 percent load changes.
  - 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- H. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
  - 1. Minimum dielectric strength of 1000 V.
  - 2. Maximum response time of 10 nanoseconds.
  - 3. Minimum transverse-mode noise attenuation of 65 dB.
  - 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

### 2.7 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
  - 1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
  - 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform automatic system diagnostics; monitor system and report failures.
  - 3. Enclosure: NEMA 1 Dustproof rated for operation at 32 to 120 deg F for mounting in conditioned space.
  - 4. Enclosure: MENA 3R Waterproof rated for operation at 40 to 150°F for mounting outdoors or in wet ambient conditions.

### 2.8 ANALOG CONTROLLERS

- A. Step Controllers: 6- or 10-stage type, with heavy-duty switching rated to handle loads and operated by electric motor.
- B. Electric, Outdoor-Reset Controllers: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range, adjustable set point, scale range minus 10 to plus 100°F, and single- or double-pole contacts.
- C. Electronic Controllers: Wheatstone-bridge-amplifier type, in steel enclosure with provision for remote-resistance readjustment. Identify adjustments on controllers, including proportional band and authority.
  - 1. Single controllers can be integral with control motor if provided with accessible control readjustment potentiometer.
- D. Fan-Speed Controllers: Solid-state model providing field-adjustable proportional control of motor speed from maximum to minimum of 30 percent and on-off action below minimum fan speed. Controller shall briefly apply full voltage, when motor is started, to rapidly bring motor up to minimum speed. Equip with filtered circuit to eliminate radio interference.
- E. Receiver Controllers: Single- or multiple-input models with control-point adjustment, direct or reverse acting with mechanical set-point adjustment with locking device, proportional band adjustment, authority adjustment, and proportional control mode.

# 2.9 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters (rated for 150°C and saturated at atmospheric pressure application):
  - 1. Accuracy: Plus or minus 2% at calibration point.
  - 2. All temp sensors need to have a minimum accuracy of ±0.5°F unless a higher accuracy is required.
  - 3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.
  - 4. Wire: Twisted, shielded-pair cable.
  - 5. Averaging Elements in Ducts: Required for all areas prone to temperature stratification: 60 inches, long, flexible or where ducts are larger than 4 sq. ft.; 264 inches long, flexible or where ducts are larger than 16 sq. ft; length as required.
  - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
  - 7. Insertion Elements in Ducts: The duct sensor shall be a precision thermistor accurate to within 0.36° over the 45° to 160°F range. The material shall be packaged in 4", 8", 12" or 16" long stainless-steel tubes attached to a standard

- four-inch (4") electrical box. Use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
- 8. Outside Air Sensor: The outside air sensor shall be a precision thermistor accurate to within 0.36 deg. over the –30 to 180°F range. The active temperature sensitive element shall be sealed for moisture resistance. The sun shield shall be mounted on a weatherproof outlet box for installation on an outside surface. The outside assembly shall be located on the north side of the building, away from all devices, such as exhaust fans, that would influence the measured temperature.
- C. Pressure Transmitters/Transducers:
  - 1. Static-Pressure Transmitter: Non-directional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 1 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 0 to 10 VDC.
    - c. Building Static-Pressure Range: 0- to 0.25-inch w.g.
    - d. Duct Static-Pressure Range: 0.1- to 10-inch w.g.
  - 2. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
  - 3. Pressure Transmitters: Direct acting for water and air; range suitable for system; linear output 4 to 20 Ma, 0-5 VDC or 0-10 VDC.
- D. Pressure Transmitters/Transducers: Industrial Application, Liquid for control of hot water variable water volume (VWV) pumping:
  - 1. Three wire smart d/p cell type transmitter
  - 2. 4-20 mA or 1 to 5-volt user selectable linear or square root output
  - 3. Adjustable span and zero
  - 4. Stainless steel wetted parts, LCD display
  - 5. Environmental limits: 0 to 250F (-40 to 121C), 0 to 100% RH, 0-250 psig range
  - 6. Accuracy: 1% F.S. range less than 2 percent of span
  - 7. Output Damping: time constant user selectable from 0 to 36 seconds
  - 8. Vibration Effect: Less than 0.1% of upper range limit from 15 to 2000 Hz in any axis relative to pipe mounted process conditions.
  - 9. Electrical Enclosure: NEMA 4, 4X, 7, 9
  - 10. Approvals: FM, CSA. The transmitter shall be capable of communicating over the HART protocol.
  - 11. Manufacturer: Setra, Veris PW Series, Rosemount Inc. 3051 Series, Foxboro, Johnson-Yokagawa.
  - 12. Wiring installed by the DDC Contractor shall be equal to Beldon 9320; multi-wire 18 gauge shielded twisted cable and shall not be included in conduit containing AC circuit wiring. Control Contractor shall install continuous run of wire from the transmitter directly to variable volume pump controllers located in the mechanical rooms. Wire chilled water transmitters directly to chilled water VWV pump controller and heating hot water transmitters directly to heating hot water VWV pump controller.
- E. Carbon Monoxide Transmitter: The carbon monoxide transmitter shall have a 4-20 mA, 0-5VDC or 0-10VDC selectable output with an accuracy of +/- 3% over a measurement range of 0 to 300 ppm with 1 ppm resolution. Operating temperature range shall be -4°F

to 122°F. Transmitters shall be mounted in the appropriate housing with backplate for ease of sensor access and replacement.

F. Makeup Water Flow Meter: Onicon Model F-4600 series inline ultrasonic flow meter or approved equivalent with remote mounted display (verify with Owner prior to installation), suitable for potable water applications. 50:1 turn down with ±1% accuracy with 0.4 to 20 fps range. Install flow meter with sufficient pipe diameters as recommended by manufacturer. Provide factory authorized start-up verification of operation and calibration. Provide with remote display with 60" AFF unless directed otherwise by Owner's Representative. Flow meter shall have 4-20 mA for flow reading and wired to BAS. Flow meter shall be provided by ATC and installed by Mechanical contractor according to manufacturer's recommendations.

# G. Water Flow Metering Devices:

- 1. Equal to Onicon Model FT-3000 Series inline electromagnetic Flow Meter with remote mounted display (verify with Owner prior to installation).
- 2. Accuracy: +/- 0.2% of reading from 1.6 fps to 33 fps.
- 3. Repeatability: +/- 0.1%.
- 4. Velocity Range: 0.10 to 39.4 fps.
- 5. Pipe Size Range: ½" to 24".
- 6. Output: Minimum of two 4-20 mA outputs and one scalable pulse output 0-10kHZ.
- 7. Construction: Housing and flanges to be carbon steel; rubber liner; Alloy C electrodes; 316 stainless steel pipe spool and grounding rings; cast aluminum with powder coat amplifier housing.

# 2.10 STATUS SENSORS

- A. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- B. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- C. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current of the application and DDC system output requirements.
- D. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 80 psig. (Shall be wired directly to pump controller.)
- E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- F. Electronic Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

### 2.11 CONTROL DAMPERS:

- A. Sheetmetal contractor shall furnish Dampers required for the systems, except where specifically required to be furnished with the equipment. Controls contractor shall coordinate actuator-mounting requirements with sheet metal contractor prior to installation. Controls Contractor shall furnish and install all 24-volt, 0-10VDC or 0-20 mA VDC modulating actuators and all actuators not specifically required to be installed by other trades.
  - 1. The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout rotation of the actuator.
  - 2. Where required, for power-failure/safety applications, an internal mechanical, spring-return mechanism shall be built into the actuator housing.
  - 3. All 24 VAC/VDC actuators shall operate on Class 2 wiring.
  - 4. All actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring-return actuators with more than 7 Nm (60 in.-lb) torque capacity shall have a manual crank for this purpose.

# 2.12 THERMOSTATS

- A. Room Thermostats: The room thermostat shall be a precision thermistor accurate within 0.36°F over the range of the applications. The range shall be 55° to 95°F. The thermostat shall be securely mounted into a molded plastic cover for wall mount. The thermostat shall be supplied with an RJ45 modular connector at the back suitable for connecting prefabricated sensor cables, the other end of the sensor cables to plug into the controller in the associated mechanical equipment. Provide an override and set point adjustment feature integral to the room thermostat.
- B. All thermostats are to be provided and installed by the temperature and controls contractor.
- C. The thermostat shall have an unoccupied override button and an integral communications port.
- D. All thermostats provided for the project shall be similar in size and appearance.
- E. Furnish room thermostats with tamper proof covers where required/requested by Owner/Engineer prior to the end of the warranty period at no additional cost.
- F. Room Temperature Sensors: The room sensor shall be a precision thermistor with 304 stainless steel plate (or color as noted elsewhere), tamperproof screws and accurate within 0.36° over the range of the applications. The range shall be -30° to 100°F. The sensor shall be supplied with 8 feet of 24 AWG pigtails prestripped ends. Controls Contractor shall interface with sensor as required.
- G. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

- H. Low Temperature Protection Thermostats (freezestats): Provide low temperature protection thermostats of manual reset type, with sensing elements of minimum twenty feet in length with one per twenty feet. Provide a thermostat designed to operate in response to the coldest one-foot length of the sensing element, regardless of the temperature at other parts of the element which when sensing a low temperature in any localized portion of the length will send alarm to front-end station. Support the element properly to cover the entire duct width. These shall cover the face of the coil at 12" centers. Provide separate thermostats for each twenty-five square-feet of coil face area or fraction thereof.
  - 1. Freezestats shall be duplex type with one (1) set of normally open contacts to provide an alarm to the DDC system.
- I. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
  - 1. Bulb Length: Minimum 20 feet.
  - 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

#### 2.13 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - 1. Available Manufacturers: Belimo, Inc. or approved equal.
  - 2. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
  - 3. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
  - 4. Nonspring-Return Motors for valves larger than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 5. Spring-Return Motors for valves larger than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
  - 6. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
  - 7. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
  - 1. Available Manufacturers: Belimo, Inc. or approved equal.
  - 2. Warranty: The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.
  - 3. Valves: Size for torque required for valve close off at maximum pump differential pressure plus 10% unless otherwise noted. Approximately 90psi (field verify final pressure prior to furnishing submittals).

- 4. Dampers: Size for running torque calculated as follows:
  - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
  - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
  - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
  - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
  - e. Dampers with 2- to 3-Inch w.g. of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
  - f. Dampers with 3- to 4-Inch w.g. of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
- 5. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle; directly couple and mount to the valve bonnet stem; or ISO-style direct-coupled mounting pad.
- 6. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
- 7. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
- 8. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators. Electronic fail safe shall incorporate an active balancing circuit to maintain equal charging rates among the Super Capacitors with a visual indication of the fail-safe status on the actuator face with the power fail position field adjustable between 0 to 100% in 10 increments, a 0-10 sec (field set) operational delay, and capable of changing the fail-safe position through an integrated switch without removing the mounted actuator
- 9. Power Requirements (Two-Position Spring Return): 24VAC/DC.
- 10. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
- 11. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
- 12. Temperature Rating: Minus 22 to plus 150 F.

#### 2.14 CONTROL VALVES:

A. Available Manufacturers: Belimo, Inc. or approved equal with minimum close rating of 110% of pump total head as scheduled on the drawings unless scheduled otherwise.

# B. General Construction:

- 1. Factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- 2. NPS 2 and Smaller: Nickel plated forged brass body, rated at no less than 250 PSI, stainless steel ball and stem, female NPT union ends, dual EPDM lubricated O-rings and a brass or TEFZEL characterizing disc.
- 3. NPS 2-1/2 through 6: GG25 cast iron body according to ANSI Class 125, standard class B, stainless steel ball and blowout proof stem, flange to match ANSI 125 with a dual EPDM O-ring packing design, PTFE seats, and a stainless-steel flow characterizing disc.
- 4. Valves shall be selected to produce a constant rate of opening/closing eliminating valve "jump" throughout the range.
- 5. All non-spring return valves shall be furnished with a manual override handle.
- 6. Manufacturer shall provide individual valve tagging on each printed valve label. Valve tag certification shall be documented on approved submitted valve schedule.
- 7. Actuators shall have two (2) year unconditional parts and labor warranty from dated of final acceptance.

# 8. Sizing:

- a. Two-Position: Line size or size using a pressure differential of 1 psi.
- b. Three-Way Modulating: Pressure drop of 50% less than the water coil pressure drop or no more than 3 psig (unless otherwise noted).
- c. Flow Characteristics: Equal percentage characteristic with rangeability of 50:1.
- d. Actuators shall be by Belimo matched with the valve application or approved equal.
- e. Calibrated Balancing Valves and Automatic Flow-Control Valves shall not be used on equipment where pressure independent control valves are installed.

# 2.15 RELAYS:

- A. Control Relays: Control relays shall be plug-in type, UL listed and shall have dust cover and LED "energized" indicator. Contact rating, configuration and coil voltage shall be suitable for application.
- B. Time delay relays: Time delay relays shall be solid-state plug-in type; UL listed and shall have adjustable time delay. Delay shall be adjustable ± 100% from setpoint shown. Contact rating, configuration and coil voltage shall be suitable for application. Provide NEMA 1 enclosure for relays not installed in local control panel.
- 2.16 Push Button Switch: Emergency Gas Shut Off Push Button with Twist-Reset, multipurpose push button with a clear protective cover to prevent accidental activations. Equivalent to American Gas Safety AGSEGOTW.
  - A. Two (2) Form "C" contacts, DPDT, rated 10 amps @ 125/250 VAC, 1/2 HP, 6 amps @ 30 VDS.
  - B. Switch rating 10 amps @ 240 VAC resistive and has a timer range: 2-60 seconds (+/-15%).
  - C. Indoor use only. Not recommended for outdoor/water applications.
  - D. Temperature range of button 15 °F to 120 °F.
  - E. 1 N.O. and 1 N.C. contact.
  - F. UL Listed to U.S. safety standards, 5VA flammability rating on back plate and spacer. Polycarbonate complies with FDA regulations for food contact applications. ADA compliant.
- 2.17 Audible Alarm Beacon: Combination audio alarm and flashing LED. Equivalent to American Gas Safety AGSAAB.
  - A. Operating Voltage: 12VDC-24VDC, 0.42A@12VDC, 0.22A@24VDC.
  - B. Operating Temperature: -4°F to 140°F.

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- C. Volume @1 foot: High 105dB, Low 85dB.
- D. Quantity of Available Flash Patterns: 8.
- E. Quantity of Selectable Sounds and Volume Control: 32.
- F. Meets IP54 requirements.
- G. Lens Tamper: N.C. 12VDC, 50mA Dry Contact.
- H. Polycarbonate Construction.
- I. Lens Color: Blue for Carbon Monoxide Alarm System and Amber for Boiler Emergency Shutdown System.
- J. Alarm Trigger: Trigger on power.

# 2.18 LOCAL CONTROL PANELS:

A. Indoor control panels shall be fully enclosed NEMA 1 construction with hinged door key-lock latch and removable sub-panels. A common key shall open each control panel and sub-panel. Pre-wire internal and face mounted device connections with color-coded stranded conductors tie-wrapped or neatly installed in plastic troughs. Field connection terminals shall be UL listed for 600 Vac service, individually identified per control and interlock drawings with adequate clearance for field wiring. Each local panel shall have a power source power switch (on-off) with overcurrent protection.

### 2.19 CONTROL TRANSFORMERS

A. Primary voltage / 24 Volt AC control transformers shall be provided and installed by the controls contractor for each mechanical equipment where not provided by the equipment manufacturer. This transformer shall power the modulating damper motor as well as the microprocessor controller. Provide junction box with terminal strip. Control transformers shall be sized for a minimum of 30% larger capacity than the expected maximum field load.

#### PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Conditioned power is not available on most projects; confirm its availability.
- B. Verify that conditioned power supply is available to control units and operator workstation.

- C. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.
- D. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.
- E. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Engineer and obtain written instructions for changes necessary to accommodate this work and work of others. Perform at own expense necessary changes in specified work caused by failure or neglect to report discrepancies.

# 3.2 INSTALLATION

- A. Install software in control units and Owners' operator workstation(s) and at locations directed by the Owner. Implement all features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Verify location of thermostats and other exposed control sensors with plans and room details prior to installation. Confirm mounting heights and exact location with Owner prior to installation. Generally located approximately 48 inches above floor.
- D. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- E. Provide guards or tamper proof enclosures on thermostats, humidistats, and room CO2 sensors at all locations when requested by Owner or Engineer (at no additional cost). Confirm quantity and type with Owner. All devices located in areas subject to abuse (i.e. within the gymnasium area) shall have protective guards installed over them.
- F. Install automatic control dampers according to Division 23 Section "Air Duct Accessories."
- G. Install damper motors on outside of ducts, not in locations exposed to outdoor temperatures/weather.
- H. Install labels and nameplates to identify control components according to Division 20 Section "Identification for HVAC and Plumbing Piping and Equipment."
- I. Install refrigerant instrument wells, valves, and other accessories according to manufacturer's requirements.

# 3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Division 26 Section "Raceway and Boxes for Electrical Systems."

- B. Install building wire and cable according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Concealed communication wire for DDC systems does not require installation in conduit. Exposed wiring such as in mechanical rooms shall be installed in conduit.
- C. Install signal and communication cable according to the following:
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Control wiring and cables shall be installed in conduit where exposed. Where low voltage wiring (less than 50V) is installed in concealed, accessible areas such as drop ceilings, cabling approved for plenum use without conduit per NFPA 262 flame test is acceptable.
  - 3. Temperature control wiring and conduit (unless otherwise indicated on the drawings and Control sections of specifications) shall be the responsibility of the Controls Contractor. All wiring and conduit, including power wiring, required for the automatic temperature control system to be fully functional shall be the responsibility of the Controls Contractor, and all costs shall be included in their proposal.
  - 4. The Controls Contractor shall have an Electrical Contractor's license or engage an Electrical Contractor to provide all power wiring, conduit and boxes required for the automatic temperature control system to be fully operational. Power wiring associated with the automatic temperature control system indicated on the electrical drawings is considered part of the Electrical Contractors scope of work and shall be included in their proposal. All cost for additional power wiring not indicated on drawings and required for controls shall be included as part of the Controls Contractors proposal and must come from an emergency power source, Life Safety branch unless otherwise required by the Authority Having Jurisdiction.
  - 5. Bundle and harness multi-conductor instrument cable in place of single cables where a number of cables follow a common path.
  - 6. Fasten flexible conductors, bridging cabinets and doors, neatly along hinge side; protect against abrasion. Tie and support conductors neatly.
  - 7. Number-code or color-code conductors, except local individual room controls, for future identification and servicing of control system.
- D. Connect electrical components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL486A.
- E. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- F. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

#### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Start-up shall include assisting the air balance contractor with the setting of the HVAC dampers and other devices. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing. Train Test and Balance Contractor to use control system interface tools. Provide a qualified technician to assist with testing and balancing. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing. The Control Contractor shall coordinate and cooperate fully with the Balancing Contractor. NOTE: The Control Contractor shall spend as much time as required to provide a fully functional, debugged system that meets the requirements of the Owner/Engineer. Controls Contractor shall fully cooperate with the TAB Contractor and all other contractors to provide complete commissioning of all building systems and equipment in accordance with Division 01, 22, 23, and 26 specifications.
- C. Start-up shall include assisting the Engineer/Owner's Representative/TAB Contractor where requested and required for Commissioning activities. Provide TAB Contractor with a complete set of the necessary tools to interface to control system for testing and balancing. Train Engineer/Owner's Representative/TAB Contractor to use control system interface tools. Provide a qualified technician to assist with commissioning. The Control Contractor shall coordinate and cooperate fully for the Commissioning process. NOTE: The Control Contractor shall spend as much time as required to provide a fully functional, debugged system that meets the requirements of the Owner/Engineer.
- D. Perform the following field tests and inspections and prepare Control Systems Commissioning Reports Indicating all results of testing:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 6. Test each system for compliance with sequence of operation.
  - 7. Test software and hardware interlocks.
  - 8. Perform DDC verification and indicate results in control systems commissioning reports.

# E. DDC Verification:

- 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
- 2. Check instruments for proper location and accessibility.

- 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
- 4. Check instrument tubing for proper fittings, slope, material, and support.
- 5. Check installation of air supply for each instrument.
- 6. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
- 7. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
- 8. Check temperature instruments and material and length of sensing elements.
- 9. Check control valves. Verify that they are in correct direction.
- 10. Check DDC system as follows:
  - a. Verify that wires at control panels are tagged with their service designation and approved tagging system.
  - b. Verify that spare I/O capacity has been provided.
  - c. Verify that DDC controllers are protected from power supply surges.
- F. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.5 ADJUSTING AND CLEANING

- A. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch up paint. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.
- B. Final adjustment: After completion of installation, adjust all sensors, transmitters, controllers, and motors provided as part of this section.
  - Final adjustment shall be performed, and record drawings shall be submitted to the Owner with an electronic copy provided to the Engineer (PDF acceptable or another electronic format approved by the Engineer). Control Contractor shall furnish a minimum of one-year warranty on all components furnished under this section.

# C. Calibrating and Adjusting:

- 1. Calibrate instruments.
- 2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
- 3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
- 4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.

- e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
- 5. Pressure:
  - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
  - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
- 6. Temperature:
  - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
  - b. Calibrate temperature switches to make or break contacts.
- 7. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
- 8. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
- 9. Provide diagnostic and test instruments for calibration and adjustment of system.
- Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- D. Adjust initial temperature and humidity set points.

# 3.6 MAINTENANCE, EXTENDED SERVICE AND SUPPORT

- A. The entire Building Automation System and DDC System, including all hardware, software, field devices and software support shall be warranted for Two-years from the date of Substantial Completion. The warranty shall include all material, labor, and monitoring services. The Temperature Controls Contractor shall provide 24 hour/day, 365 day/year, monitoring coverage for the Two-year warranty period. The Controls Contractor shall receive all Control and Equipment Failure Alarms. After receiving the alarm, the Controls Contractor shall respond to all Control alarms or notify the Owner and Equipment Vendor for all Equipment Failure Alarms. An alarm response service report shall be sent to the Owner after each event for their records. The Owner shall provide for use of internet access by the control system for remote communications and alarming.
- B. The response time for support shall be not more than 4 hours. Response to Owner reported concerns can be addressed via web browser, first, and reasonable time shall be allowed for the contractor to provide on-site support if required. The Controls Contractor shall maintain an on-site log with the Owner detailing dates and times when onsite and activities/work performed while onsite.

# 3.7 CLOSEOUT PROCEDURES, DEMONSTRATION AND TRAINING

A. The Control Contractor shall demonstrate the operation of the control system to the satisfaction of the Owner and Engineer. Schedule demonstration with all parties to be involved a minimum of two (2) weeks in advance. The control system demonstration and training shall not be scheduled until all hardware and software has been reviewed and

commissioned by the Control Contractor and their Systems Commissioning Report has been issued and reviewed. If the work fails to be demonstrated to conform to contract documents, so as to require scheduling of additional site visits by the Engineer for redemonstration, the Contractor shall reimburse the Engineer for all direct and indirect costs of subsequent site visits

- B. The Control Contractor shall demonstrate the operation of the control system to the satisfaction of the Owner, Engineer, and Owner's Representative. Schedule demonstration with all parties to be involved a minimum of two (2) weeks in advance. The control system demonstration and training shall not be scheduled until all hardware and software has been reviewed by the TAB Contractor/Engineer/Owner's Representative and their report of completion/findings has been accepted by the Engineer/TAB Contractor/Owner's Representative. If the work fails to be demonstrated to conform with contract documents, so as to require scheduling of additional site visits by the Engineer and/or TAB Contractor/Owner's Representative for re-demonstration, the Contractor shall reimburse the Owner for all direct and indirect costs of subsequent site visits.
- C. Control Contractor shall submit the training plan to the Owner and Engineer for review and approval. Plan must include course outline, syllabus, documentation utilized and lesson plans.
- D. Training shall be completed prior to the turnover of the building to the Owner. All training shall be recorded in high quality color video and audio and a minimum of two (2) copies given to the Owner in DVD format and as requested by Engineer.
- E. Manufacturer's Field Services: Provide the services of a factory-authorized service representative to demonstrate and train Owner's maintenance personnel as specified herein.
  - Obtain a written list of attendees signed by each attendee for each training session which identifies the date, starting and stopping times of session, content of session, name, and title of attendees. Attendees must be pre-approved by the Owner's Representative and Engineer. Training sessions that do not provide the appropriate signatures and approvals shall be rescheduled and repeated at no additional cost to the Owner.
  - 2. Materials shall be provided for up to four (4) Owners designated personnel.
  - 3. Schedule all training with Owner and Engineer with at least two (2) weeks' notice.
  - 4. Include all costs of travel, lodging, training labor, course materials, and any related costs necessary to provide full training and comply with this section.
  - 5. The training will be tailored to the needs and skill-level of the trainees.
  - 6. The trainers will be knowledgeable on the system and its use in buildings. For the on-site sessions, the most qualified trainer(s) will be used. The Owner and Engineer shall approve the instructor prior to scheduling the training.
  - 7. Training manuals. The standard operating manual for the system and any special training manuals will be provided for each trainee, with three extra copies left for the O&M manuals. In addition, copies of the system technical manual will be demonstrated during training and three copies submitted with the O&M manuals. Manuals shall include detailed description of the subject matter for each session.
  - 8. The manuals will cover all control sequences and have a definitions section that fully describes all relevant words used in the manuals and in all software displays.

- 9. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system will be repaired or adjusted as necessary, and the demonstration repeated.
- 10. The controls contractor shall attend sessions other than the controls training, as requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.
- F. There shall be a minimum of three (3) training sessions:
  - 1. Training I Control System. The first training shall consist of a minimum of 24 hours, conducted in half-day increments, or longer as requested by the Owner, of actual control system training. This training will be held through phone support or e-meeting or on-site. Upon completion, each trainee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.
  - 2. Training II Building Systems. The second session shall be held on-site for a minimum period of 40 hours, conducted in 2 hours to half-day increments or longer as requested by the Owner, of actual hands-on training after the completion of system commissioning which may occur of the 24-month warranty/service period with all costs for training in base bid. The session shall include instruction on:
    - a. Specific hardware configuration of installed systems in this building and specific instruction for operating the installed system, including HVAC systems, lighting controls and any interface with security and communication systems.
    - b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, troubleshooting, servicing, and preventive maintenance, changing set points and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.
    - c. All trending and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends. Trainees will actually set-up trends in the presence of the trainer.
    - d. Every screen shall be completely discussed, allowing time for questions.
    - e. Use of keypad or plug-in laptop computer at the zone level.
    - f. Use of remote access to the system via phone lines or networks.
    - g. Graphics generation.
    - h. Point database entry and modifications.
    - i. Understanding DDC field panel operating programming (when applicable).
    - j. Web based access and control, including user and password setup, and access level assignment. This shall include the procedures to establish the data and graphics that can be viewed or adjusted by web-based clients, including the nursing staff.
    - k. Review data in the maintenance manuals specified in Division 1.
    - Additional demonstration and training requirements to be included during these training sessions can be found in Division 23 Section "Sequence of Operations for HVAC Control."
  - 3. Training III. The third training will be conducted on-site six months after occupancy and consist of 8 hours of training. The session will be structured to address specific

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topics that trainees need to discuss and to answer questions concerning operation of the system.

# 3.8 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Provide as many additional Project site visits as required to meet the service and maintenance warranty and when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

END OF SECTION 230900

#### SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.
- D. Controls contractor shall tie all the new building automation system from existing to new DDC control system. REUSE EXISTING CONTROL WIRING, CONDUIT, SENSORS AND ACCESSORIES AS MUCH AS POSSIBLE UNLESS NOTED OTHERWISE. INSTALL NEW SENSORS AND DEVICES, IF EXISTING ONES ARE NOT COMPATIBLE WITH CONTROL SYSTEM. ALL THE NEW EQUIPMENT SHALL BE PROVIDED WITH NEW CONTROLS. REFER TO FLOOR PLANS FOR INFORMATION ON EXISTING AND NEW EQUIPMENT.

#### 1.2 DESCRIPTION OF WORK

- A. Operating equipment, devices, and system components required for control systems are specified in other Division 23 control sections of these specifications.
- B. All equipment (valves, actuators, controllers, etc.) required to perform the functions specified shall be provided by the Automatic Temperature Controls (ATC) Contractor except for items furnished by equipment manufacturer or mechanical contractor. Temperature Controls Contractor shall coordinate damper size, accessories, and installation requirements for installation of control damper actuators. Control dampers shall be provided by sheet metal contractor. Electric motor driven equipment shall be provided with minimum on (run) and minimum off timers to prevent short cycling of the equipment (coordinate with equipment manufacturer's recommendations). All DDC system control points shall have a default value in case of sensor failure or logic error. All controlled devices shall fail safe on loss of control. All set points and parameters shall be fully adjustable.
- C. The Controls Contractor shall field verify all required control points prior to bidding and include all costs in bid so the facility is being controlled from the same existing Trane Tracer control system. The design intent is to have new DDC controls that seamlessly interface with the existing Trane Tracer System. Any required software and/or hardware upgrades to the existing system shall be provided by the ATC.

PART 2 - PRODUCTS (Not Applicable to this Section)

### PART 3 - EXECUTION

#### 3.1 SEQUENCE OF OPERATION – GENERAL

- A. When air handling unit is not in operation, control devices shall remain in their "off" positions. "Off" positions may differ from the "normal" (meaning failed) position. Except as specified otherwise, "off" and "normal" positions of control devices shall be as follows:
  - 1. Device "Off Position" "Normal" Position
  - 2. Outside Air Damper, off position closed, normal position closed
  - 3. Relief/Exhaust air damper, off position closed, normal position closed
  - 4. Variable Frequency Drive, off position off, normal position minimum speed
- B. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials shall be centered on the associated set point. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Unless the loop is specified "proportional only" or "P+I", Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.
- C. All the point names shall have a standard naming convention. All the equipment shall have unique tag as shown on the drawings.
- D. For units that serve the same space, the programming logic shall be implemented to avoid simultaneous cooling and heating. Fans, pumps controlled by the DDC contractor shall have run hours accumulated.
- E. All the thermostats to have unoccupied override button. Thermostats shall monitor space carbon dioxide and relative humidity where mentioned.
- F. All the equipment graphics used for space conditioning shall have current occupied/unoccupied heating and cooling setpoints. Floor plan graphics shall be color coded and shall have room names, numbers, space temperatures, humidity, carbon monoxide and carbon dioxide readings, etc.
- G. Scheduling: Provide the capability to schedule each piece of equipment and group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [15] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. The controls contractor shall work with the Owner to set up the schedules and assist them throughout the service period on addressing any issues related to using the schedules by providing proper training to the Owner's designated staff to ensure the Owner fully understands how to optimize the schedules. The DDC system shall provide the Owner with the ability to override the schedules, both centrally and individually. Schedules shall be completely adjustable by the Owner at the front-end workstation. Each schedule shall consist of the following:

- 1. Weekly Schedule. Provide separate schedules for each day of the week.
- 2. Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
- 3. Holiday Schedules. Provide the capability for the operator to define up to [99] special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period
- 4. Optimal Start/Stop. The scheduling application outlined above shall support an optimal start/stop algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start/stop algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit
- 5. System shall have ability to be put in holiday that affects all buildings, or single buildings, or sub- groups of equipment in a building, or a piece of equipment. (for example, a snow day for that affects the building only has to be put into the system in one place as a "holiday" and as soon as expires the "normal" schedules are in effect again).
- 6. System shall have ability to put a building, group, or piece of equipment into override. All buildings are typically turned to unoccupied via a Holiday that overrides the Normal schedule. However, special events will require certain areas or pieces of equipment to be turned on at any given building. The Override function allows these to be turned on).
- 7. Base/default time in all schedules shall be unoccupied. If there is no event, or no schedule, the item is to be UNOCCUPIED. Do not require the user to put in both unoccupied time and occupied time for schedules. Only occupied time is to be put in
- H. Schedules shall be completely adjustable by the owner at the front-end workstation. The controls contractor shall implement an Owner approved schedule once the system has been fully tested and is operational. The following preliminary schedule shall be coordinated and verified by the Owner prior to final implementation of the specific schedule that meets the Owner's needs
- I. Remote Communications. The system shall have the ability to email or text alarm message. The system shall use a priority array to determine which alarms to send out and to whom.
- J. Start/Stop commands shall be wired through auto side of motor starter control. Hand position shall bypass BAS DO control point but not hardwired safeties.
- K. Alarm messages specified throughout the sequences are assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports and are defined in this Section under ALARMS - GENERAL. Where a priority level is not specifically indicated, provide level 5 alarms.

- L. Where a set point or value is indicated as "adjustable" (adj.) in the sequences, it shall require that the value be changeable by an operator with the proper password level from any workstation via a graphic without editing program logic. Using a virtual set point or use of template parameter input screens are acceptable.
- M. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, Contractor shall determine a fixed reset schedule that shall result in stable operation and shall maintain the primary variable within the specified maximum allowable variance.
- N. Where a reset temperature is specified, do not extrapolate beyond the indicated limits.
- O. Where "prove operation" of a device (generally controlled by a digital input) is indicated in the sequence, it shall require that the Building Automation System (BAS) shall, after an adjustable time delay after the device is commanded to operate (debounce time), confirm that the device is operational via the status input. If the status point does not confirm operation after the time delay or anytime thereafter while the device is commanded to run, an alarm shall be enunciated audibly and via an alarm message at the operator interface and, if applicable, send out an alert via text message or email to the appropriate personnel. A descriptive message shall be attached to the alarm message indicating the nature of the alarm and actions to be taken. Contractor shall provide messages to meet this intent. Coordinate alarm function requirements with Owner's preferences at no additional cost.
- P. Refer to available drawings for additional information related to sequences for supply fans, pumps, etc.
- Q. General Set Points (adjustable):
  - 1. Unoccupied heating space temperature set point is 65°F during scheduled off times, but 2 degrees adjustable below occupied heating setpoint or above cooling setpoint when sensor shows the space is unoccupied during scheduled occupied times.
  - 2. Occupied space temperature set points for all conditioned spaces shall be 72°F.
  - 3. Heating and Cooling differential shall be 3°F.
  - 4. Room relative humidity setpoint is 55% unless otherwise indicated (differential set at 5% RH) for cooling periods.
  - 5. Primary Boiler Water Loop Supply temperature heating mode is 140°F; however, 180°F may be needed until all the new HVAC equipment is installed.

# 3.2 ALARMS - GENERAL

A. Alarm Priority Levels: Alarm messages specified below and throughout this Section - shall be assigned to one of the following priority levels. Level 1 is the most critical. Level 5 is the least critical. Unless otherwise specified, alarm messages shall be assigned to priority level 5. If the BAS does not have the capability of displaying the entire specified message, it shall condense the message as necessary; if the entire meaning of the message cannot be included, the message shall reference a code number that refers to an alarm code list. The alarm code list shall be provided by the contractor with a third-party database, spreadsheet, or word processor software package in a format that is

searchable using the alarm code number. Return to normal conditions for all alarms shall be reported at the same priority level. Alarm message reporting shall conform to the Owner's existing reporting criteria.

- B. Override Alarms: Any point that is overridden through the override feature of the graphic workstation software shall be reported as a Level 3 alarm.
- C. Analog Input Alarms: For each analog input, program an alarm message for reporting whenever the analog value is outside of the programmed alarm limits. Report a return to normal message after the analog value returns to the normal range, using a programmed alarm differential. The alarm limits shall be individually selected by the contractor based on the following criteria:
  - Space temp. and humidity, except as otherwise stated in sequence of operation: Level 3
  - 2. Low alarm: 68F.
  - 3. Low return to normal: 69F.
  - 4. High alarm: 78F.
  - 5. High return to normal: 77F.
  - 6. High alarm: 60% relative humidity.
  - 7. Controlled media temperature other than space temperature (e.g. AHU discharge air temperature). If controlled media temperature set point is reset, alarm set points shall be programmed to follow set point: Level three (3).
  - 8. Low alarm: 3F below set point
  - 9. Low return to normal: 2F below set point
  - 10. High alarm: 3F above set point
  - 11. High return to normal: 2F above set point.
- D. HOA Switch Tampering Alarms: The sequences of operation are based on the presumption that motor starter Hand-Off-Auto (HOA) switches are in the auto position. If a motorized equipment unit starts without a prior start command from the BAS, (as sensed by status sensing device), then BAS shall perform the remaining sequence as specified. BAS shall also enunciate the following Level 5 alarm message if status indicates a unit is operational when the run command is not present.
  - 1. DEVICE XXXX FAILURE: {The device} Status is indicated ON even though it has been commanded to stop. Check the HOA switch, control relay, status-sensing device, contactors, etc. involved in starting the unit. Acknowledge this alarm when the problem has been corrected.
- E. Maintenance Alarms: Enunciate Level 5 alarms when runtime accumulation exceeds a value specified by the operator
  - 1. DEVICE XXXX REQUIRES MAINTENANCE. Runtime has exceeded specified value since last reset.
  - 2. Enunciate the following alarm as a priority whenever an air handling unit requests heating when the outside air temperature is above 65°F.
    - a. DEVICE XXXX: Heating is being requested even though the outside air temperature is above 65°F.

#### 3.3 MONITORING AND ALARMS

- A. The following points shall be monitored and alarmed at the monitoring console and as otherwise specified hereinafter:
- B. Point Descriptions:
  - 1. High/Low Temperature Alarms on all DDC temperature sensors with off-normal messages.
  - 2. Current Switches Provide for supply fan,.
  - 3. High room Carbon Monoxide alarm.
  - 4. Pump failures.
  - 5. Differential Pressure Switches. Provide for status for all pumps.
  - 6. Variable Frequency Drive failures.
  - 7. Boiler failures.
  - 8. Emergency boiler shut off alarm
- C. When interfacing with equipment providing remote analog inputs or receiving analog outputs to the new DDC system, coordinate all requirements such as range, signal condition, grounding, and input impedance with the supplier of the equipment being monitored.

#### 3.4 EMERGENCY BOILER AND DOMESTIC WATER HEATER SHUTDOWN SYSTEM:

- A. ATC shall furnish and install a new emergency shutdown system. ATC furnish and install new control wiring, conduit, sensors, accessories, and control devices as noted on the drawings. The controls contractor shall install new sensors, control accessories and devices, control system to provide a complete operational system. The ATC shall provide minimum DDC control/monitor points, graphics, alarms, and trends for a complete operational DDC system.
- B. Furnish and install emergency shutdown button at each door in the boiler room, a break glass push button station equal to Kele ESB Series Operator Station. Station shall have bright red finish, hammer with attaching chain and name plate reading "TO OPERATE, BREAK GLASS TO STOP BOILER".
- C. The break glass stations are series wired to a new multi-pole relay in NEMA 1 enclosure. The relay contacts are wired into the burner limit circuit of the three new boilers. Coordinate an auxiliary contact with new boilers, and provide necessary devices to allow for ATC interface. Wiring and devices shall be by ATC contractor.
- D. An additional relay contact shall close to energize multiple Edwards No. 50 AdaptaBeacon (or equivalent) with rotating light in an amber color lens. Beacons shall be mounted near the ceiling at a point relatively common to all equipment. The beacons will alert operator that multi-pole relay is de-energized. Wiring and devices by ATC contractor.
- E. Coordinate the emergency shutdown system with the new boilers. The wiring of the emergency shutdown system shall be by ATC contractor.

- 3.5 CARBON MONOXIDE MONITORING & ALARMING (Boiler Room Mech#1)
  - A. Control Contractor shall furnish and install room carbon monoxide (CO) Monitoring in Specific rooms/areas: Whenever the room CO sensor detects levels of 30 ppm (adj.) or higher of CO a 24-volt strobe light and alarm horn shall sound an alarm. Blue strobe/horn equal to Kele Model 869STR-B-AQ (24V) shall be furnished and installed by Controls Contractor. Also, provide test and acknowledge button for manual testing of alarm device located in the room. Locate horn/strobe in room or in the adjacent room in location approved by the Owner/ Engineer. Provide signage to label strobe/horn "Carbon Monoxide Alarm". Confirm size/color of lettering with Owner.
  - B. Minimum DDC Point Configuration per area:
    - 1. Room CO Alarm DO
    - 2. CO Level Al
  - C. Graphics: Include graphics of CO alarm on floor plan and associated with its respective equipment (i.e. Boiler Room).
- 3.6 MECHANICAL & ELECTRICAL ROOM VENTILATION CONTROL (SF-1)
  - A. The fans shall be connected to the Facility Management System for scheduling and control. The fans shall be Start when the space temperature exceeds space set point and operate at low speed. Stop when the space temperature is 5°F (adjustable) below space set point. Send an alarm to the BAS when fan has been energized and space temperature continues to fall after 10 minutes (adjustable). When the space temperature rises above the temperature setpoint of 78°F (adj.), the DDC system shall enable supply fan while monitoring the discharge air temperature which shall be above 52°F (adj.) and be maintained as a minimum by modulating return air damper.
  - B. The DDC system shall modulate the fan speed from low to high speed to maintain space temperature. As the space temperature approaches the setpoint, the DDC system shall reverse the fan speed until space temperature set point has been achieved and supply fan disabled and dampers close. During this operation, the DDC system shall modulate the supply fan speed between the design minimum and maximum airflows (speeds) to maintain the space temperature setpoint. The supply fans shall be locked out when outside air temperature is below 35°F(adj.) and the dampers shall remain closed.
    - SF VFD Start/Stop DC
    - 2. SF Status/VFD Alarm DI
    - 3. SF VFD Control AO
    - 4. SF Damper Open/Close DO
    - 5. SF Damper Status DI (through end switches)
    - 6. Space Temperature Al
    - 7. Space Set point Al
    - 8. Space Schedule Override DI
    - 9. Relief Air Damper Open/Close DO
    - 10. Relief Air Damper Status DI (through end switches)
    - 11. Return Air Damper Modulation AO
    - 12. Return Air Damper Position Al

- 13. Discharge Temperature Al
- 14. Outside Air Temperature Sensor AI (Global Sensor may be used)
- C. Safeties: The following safeties shall be provided to stop the supply fan(s) and position the control devices to their "fail safe" position, i.e., shut off dampers. Safeties shall be wired into the fan starter circuit such that the safety shall function whether the starter selector switch is in the hand or automatic position. (Wiring by Controls Contractor)
  - 1. Low Temperature Limit Cutout "Freeze-stats" The supply fan discharge temperature shall also act as a freeze stat and shall read above 37F (adjustable) as a permissive for the supply fan to start. If the temperature falls below the warning set point (34F initial setting) an alarm shall be annunciated on the BAS monitoring screen and alarm logging system. If the temperature falls below the fan shutdown set point (33F); the corresponding ERV supply fan shall be deenergized; and an alarm shall be annunciated on the BAS monitoring screen and alarm logging system.
- D. Alarms: The microprocessor controller shall monitor the fan system and send the following alarms to the front-end workstation. The alarms shall be displayed on the graphics screen and remote notification shall be sent out to maintenance personnel. All alarms shall be recorded to a hard drive file for future reference.
  - 1. Supply Fan Failure
  - 2. Supply Damper Failure
  - 3. Low Space Temperature Alarm
  - 4. Relief Air Damper Failure
  - 5. Return Air Damper Failure
  - 6. Return Air Damper Failure
  - 7. Low Discharge Temperature Alarm
  - 8. Freeze Alarm using supply air temperature
- E. Graphics: The front-end graphics shall include a graphic picture for ventilation system with mark number and dampers. The data shall be dynamic and include occupied or unoccupied mode of operation. The graphic shall include a control panel screen and indicate status. The Operator shall be able to adjust all set points as listed from this screen. They shall be the following:
  - 1. On/Off Setting
  - 2. Occupied Off Time
  - Occupied On Time
  - 4. Unoccupied Temp. Set point High Limit
  - 5. Unoccupied Temp. Set point Low Limit
  - 6. SF Speed
  - 7. Relief Damper Status (open/closed)
  - 8. Return Damper Position (% Open)
  - 9. SF Damper Status (open/Closed)
  - 10. Discharge Air Temperature
  - 11. Occupied Temp. Set point High Limit
  - 12. Occupied Temp. Set point Low Limit
  - 13. Maximum SF Speed Setting
  - 14. Override Timer Setting

# 15. Minimum SF Speed Setting

# 3.7 HYDRONIC HEATING HOT WATER SYSTEM (B-1, B-2, AND B-3 & associated pumps)

- A. ATC shall coordinate with boiler mfr. to properly interface with boiler controls to provide a complete operational system and integrate the controls for the new equipment with existing building's Trane DDC system. The ATC shall provide minimum DDC control/monitor points, graphics, alarms, and trends for a complete operational DDC system, but not limited to the points mentioned below and on the control drawing. ATC shall provide necessary control devices and accessories to achieve the sequences described below. All three boilers (B-01,02 & 03) and associated boiler pumps (HWP-01,02 & 03), piping and accessories are new. The distribution hot water equipment and hydronic pumps P-1 and P-2 are existing to be reused. Refer to flow diagram for existing to remain and new equipment and accessories. The building hot water system shall be controlled via BAS system and the boiler master controller. The Boiler mfr. shall furnish boiler controls to optimize and control the operation of the new boiler plant to satisfy the building needs. ATC shall install the sensors provided by the boiler mfr. and provide necessary wiring, conduit, and labor.
- B. The BAS and boiler system controller shall control the hydronic hot water pumps, and boilers to satisfy the hydronic loop temperature. The BAS and boiler system controller shall enable the boilers as required to maintain the HWS temperature describe below. BAS shall enable whenever the system has 2 (adjustable) calls for heating or outside air temperature falls below 38°F (adjustable). Once enabled the system shall operate for a minimum of 1 hour (adjustable). The system shall be disabled when the heating hydronic loop controller is not requesting heat AND outside air temperature rises to 72°F (adjustable) or greater. In the event of control system failure, a Manual Start-up, Boiler and Hot Water Pumping System Operation Procedure shall be posted on the Mechanical Room wall in a permanent plexi-glass covered frame.
- C. During the boiler plant start-up, ATC shall coordinate with boiler mfr. to ensure that an alternate lead boiler is programmed, which allows the alternate lead boiler to automatically assume control of the boiler plant in case the boiler master controller loses communication. When the DDC system indicates that the heating system shall be activated, the boiler control system shall determine which boiler shall be activated. The boiler control system shall be furnished by the boiler manufacturer for lead-lag control and optimized operation of the boilers, for modulating and on-off burner control, for reset of hot water supply temperature in accordance with outdoor air temperature, for monitoring and alarming high boiler water pressure, and for modulating control of the variable water volume boiler loop pumps. When boiler master controller receives a signal from the DDC system to activate the heating system, it shall energize the boiler loop hot water pump associated with the lead boiler. Once it determines that flow is proven through the lead boiler, the boiler control system shall energize the lead boiler and control its burner. The boiler control system shall also determine through its optimization program when each of the two lag boilers should be energized. When a boiler is deenergized by the boiler control system, its boiler loop hot water pump shall continue to operate for a period of 30-minutes (adjustable) before it too is de-energized by the boiler control system. The boiler control system shall extend the burner firing periods to increase seasonal efficiency by reducing burner on-off cycles and avoiding thermal losses with excessive pre-purge and post-purge cycles. The boiler control system shall

- adjust boiler response to load changes by analyzing return water temperature, outside air temperature, boiler water temperature and blend temperature to the load. The boiler control system shall alternate the designation of the lead boiler and the lag/stand-by boilers after 250 hours (adjustable) of cumulative firing time of the lead boiler. The boiler control system shall stage the three boilers on and off in an energy efficient manner.
- Existing Pumps (P-1 & P-2): All boilers and pumps shall operate as needed to satisfy the D. heating needs. The lead pump shall be enabled and operate continuously. The setpoint for the HW differential pressure transmitters (HWDP) shall be field determined and adjusted during system balancing to provide the required water flow to all coils throughout the range of operation. The BAS shall provide a signal to the modulate the lead HW pump VFD speed to maintain the HWDP setpoint. If the lead HW pump speed has been increased to 90% (adj.) and is unable to maintain the HWDP setpoint, the BAS shall enable the lag HW pump and shall modulate both pump VFDs simultaneously with the same signal to maintain the HWDP setpoint. While both pumps are in operation, if the output signal drops below 40% (adj.), the BAS shall disable the lag pump and control the lead pump to maintain the HWDP setpoint. When disabled, the pumps shall remain off for a minimum of 3 minutes (adj.) to prevent short cycling of the pumps. The BAS shall rotate the lead/lag pump bi-monthly (adj.) to equalize runtime. Proof of pump operation shall be made via differential pressure sensors prior to any boilers being enabled. If the lead pump fails to operate when commanded, lock out the lead pump, send an alarm to the front-end workstation and automatically start the lag pump for operation.
- E. Boiler Startup: On a call for heating, the BAS shall prove that no safeties prevent allowing any boilers to be enabled. When a boiler is enabled, the boiler controls shall enable the associated boiler pump. On proof of flow, the boiler shall fire to maintain the HWS temperature. Once a boiler has been started it shall run for a minimum of 15 minutes (adj.).
- F. Boiler Shutdown: When a boiler is no longer needed, the boiler shall be shut down and the associated boiler pump shall run a minimum of 5 minutes (adjustable) after the boiler is called to be shut down then stop.
- G. Alternating Boiler Assignment: Alternating boiler assignments shall rotate between boilers B-1, B-2 & B-3 on a 30-day (adj.) basis though the boiler manufacturer's boiler control panels on each boiler connected via BACnet interface with BAS and field installed communication wiring provide by the controls contractor between each boiler controller. Alternating boiler assignments shall be indicated on graphic screen. Controls contractor shall coordinate with boiler mfg./supplier for required interface and additional control requirements.
- H. Lead Boiler: Upon a call for heating from the as HW supply water temp 2°F (adj.) below set point 160°F (adjustable), BAS shall initiate the Boiler Startup sequence for the lead boiler. When the HW water temperature is 2°F above set point for a period of 10 minutes (adjustable) the BAS shall initiate the Boiler Shutdown sequence for the lead boiler. Upon a lead boiler pump or boiler failure, start lag boiler pump and boiler, remove and lock out failed boiler pump and boiler start command, and annunciate alarm to the front-end workstation. Controls Contractor shall verify setpoints during the heating seasons and document setpoints that maintain comfort while still operating HWS as low as possible

for energy savings. The boiler control system shall enable one of the two lag/standby boilers if the lead boiler has a flame failure or any type of safety shutdown.

- I. Contractor shall provide boiler pressure transducer shall monitor boiler water pressure to avoid relief valve weeping or opening caused by failure of pressure regulating valve on cold water supply line or caused by incorrect pressurization of the bladder-type expansion tank. A common manual reset alarm light shall be provided.
- J. Emergency stop buttons, located at each entrance to the boiler room will close a main gas valve, disable all hot water boilers and send an alarm to the BAS any time the buttons are depressed. Each boiler pump shall be provided with an EC motor or variable frequency drive. The boiler pump shall vary its speed to match demand as determined by the boiler manufacturer's controller.
- K. Hot water temperature reset: The boilers shall be controlled to modulate the heating hot water supply temperature on a reset schedule based on heating demand. Heating water supply temperatures shall be 160°F (adjustable or higher if required for existing equipment) during cold weather and reset to 120°F (adjustable) (verify minimum temperature with boiler manufacturer) whenever heating requests are minimal and outside air temperatures are above 70°F (adjustable).(adjustable)
- L. Paralleling Boilers: BAS shall initiate the Boiler Startup sequence for the boilers through the boiler control panels for maximum efficiency while equalizing run time.
- M. Boiler HW Temperature Alarms: On a call for all boilers to be enabled and the HWR temperature drops 10°F (adj.) below setpoint annunciate a low temperature alarm to the front-end workstation. On a rise in the boiler leaving water temperature to 180°F (adj.) annunciate a high temperature alarm to the front-end workstation.
- N. Alarms: The microprocessor controller shall monitor the hydronic heating hot water system and send the following alarms to the front-end workstation. The alarms shall be displayed on the graphics screen and remote notification shall be sent out to maintenance personnel. All alarms shall be recorded to a hard drive file for future reference.
  - 1. Boiler Failure/Alarm
  - 2. Pump Failure
  - 3. HWS-R Temperature High/Low Alarm
  - 4. Dirty By-pass Filter Alarm
  - 5. Boiler Emergency Switch activated alarm
  - 6. Annunciate an alarm whenever pump restarts in less than 10 minutes after turning off. Message shall be as follows:
  - 7. Pump P-X CYCLE ALARM: HW Pump is cycling faster than recommended. Check the stability of the loop causing the heating request.
- O. Minimum DDC point configuration: Furnish all points to meet the required sequence of operation including the following for the heating hot water system:
  - 1. B-1 Boiler Start/Stop DO
  - 2. B-2 Boiler Start/Stop DO
  - 3. B-3 Boiler Start/Stop DO

- 4. B-1 Boiler Alarm DI
- 5. B-2 Boiler Alarm DI
- 6. B-3 Boiler Alarm DI
- 7. B-1 Setpoint AO
- 8. B-2 Setpoint AO
- 9. B-3 Setpoint AO
- 10. B-1 Proof of Flow (by boiler mfr.) DI (coordinate with boiler mfg.)
- 11. B-2 Proof of Flow (by boiler mfr.) DI (coordinate with boiler mfg.)
- 12. B-3 Proof of Flow (by boiler mfr.) DI (coordinate with boiler mfg.)
- 13. P-1 Pump Start/Stop DO
- 14. P-1 Speed Al
- 15. P-1 Pump VFD Status/failure alarms DI
- 16. P-1 Pump Status/failure alarm thru CT DI
- 17. P-1 Pump Status/failure alarm thru DPS DI
- 18. P-2 Pump Start/Stop DO
- 19. P-2 Speed Al
- 20. P-2 Pump VFD Status/failure alarms DI
- 21. P-2 Pump Status/failure alarm thru DPS DI
- 22. P-2 Pump Status/failure alarm thru CT DI
- 23. Primary HWS Temp °F AI
- 24. Primary HWS Temp. Set point AO
- 25. Primary HWR Temp °F AI
- 26. B-1 HWS temp. °F AI
- 27. B-2 HWS temp. °F Al
- 28. B-3 HWS temp. °F AI
- 29. Outside Air Temperature °F AI (Global Sensor)
- 30. Flow Meter Boiler Loop (FM-1) Al
- 31. Flow Meter Building Loop (FM-2) Al
- 32. HWP-1 Start/Stop DO
- 33. HWP-2 Start/Stop DO
- 34. HWP-3 Start/Stop DO
- 35. HWP-1 Pump Status DI
- 36. HWP-2 Pump Status DI
- 37. HWP-3 Pump Status DI (Differential Pressure)
- 38. Differential pressure filter feeder DI
- 39. Boiler Emergency Shutdown Switch DI
- 40. Make-up water flow meter Al
- 41. Make-up water two way control valve DO
- P. Graphics: The front-end graphics shall include a graphic picture of the above boiler plant and miscellaneous points including the global outside air temperature. The data on this graphic shall be dynamic and include all inputs and outputs as listed and software set points requested by Owner / Engineer. The graphic shall also include a control panel screen. The operator shall adjust all set points as listed in the above sequence from this screen. Each set point shall also have a dead band the operator can adjust from this screen.

- 3.8 FLOW METER ALARMS AND EMERGENCY SHUTDOWN FOR MAKE-UP WATER (HOT WATER HYDRONIC FILL SYSTEMS)
  - A. Controls contractor shall furnish a two-way, two position, normally open valve and flow meter for hot water hydronic systems to be installed by MC. Valve shall close if (after a time delay of 2 minutes) the make-up water continues flowing at a rate of 2 gpm (adjustable) while the system switch is in the normal operating position. An alarm shall be sent to the BAS. An audible alarm mounted on the control panel (mounted very near the makeup water system) shall sound and an indicator light will provide visual indication of a problem. A momentary push button on the panel shall be used to silence/acknowledge the alarm and reset system for normal operation after any necessary repairs are made. A switch mounted on the panel shall be used to shut down the alarm while normal system fill operations are performed. This switch and all panel mounted devices are to be appropriately labeled. Provide and coordinate installation by MC.
  - B. Minimum DDC Point Configuration: D. Alarms: The microprocessor controller shall monitor the flow meter and send the following alarms to the front-end workstation. The alarms shall be displayed on the graphics screen.
    - 1. Make-Up Water Valve Open/Close DO
    - 2. Flow Meter Al
  - C. Graphics: The front-end graphics shall include a graphic picture of the above system. The data on this graphic shall be dynamic and include all inputs and outputs as listed and software set points requested by the Owner/Engineer. The graphic shall also include a control panel screen.
  - D. All alarms shall be recorded to a hard drive file for future reference.
    - 1. Flow Meter Alarm

#### 3.9 CONTROL SYSTEM DEMONSTRATION

- A. Temperature Controls Contractor shall demonstrate the operation of the Control Systems hardware, software, and all related components and systems to the satisfaction of the Owner/Engineer. Schedule the demonstration with the Owner/Engineer two (2) weeks in advance. Demonstration shall not be scheduled until all hardware and software submittals, and the Commissioning Test Report is approved.
- B. If the Work fails to be demonstrated to conform to Contract specifications, so as to require scheduling of additional site visits by the Engineer for re-demonstration, Contractor shall reimburse Owner/Engineer for all direct and indirect costs of subsequent Engineer site visits.
- C. The Temperature Controls Contractor shall supply all personnel and equipment for the demonstration, including, but not limited to, instruments, ladders, etc. Temperature Controls Contractor supplied personnel must be competent with and knowledgeable of all project-specific hardware, software, and the HVAC systems. All training documentation and submittals shall be at the job site.

- D. The system shall be demonstrated following the same procedures used in the Commissioning Tests by using approved Commissioning Checklists. Demonstration shall include, but not necessarily be limited to, the following:
  - 1. Demonstrate that all required software is installed on workstations. Demonstrate that all graphic screens, alarms, trends, and reports are installed as submitted and approved. Refer to Building Automation System Software Commissioning in this spec for additional detailed procedures.
  - 2. Demonstrate that all points specified and shown can be interrogated and/or commanded (as applicable) from all workstations, as specified.
  - 3. Demonstrate that remote communication abilities are in accordance with these Specifications.
  - 4. Demonstrate correct calibration of input/output devices using the same methods specified for the commissioning tests. A maximum of 10 percent of I/O points shall be selected at random by Engineer/Owner for demonstration. Upon failure of any device to meet the specified end-to-end accuracy, an additional 10 percent of I/O points shall be selected at random by Engineer/Owner for demonstration. This process shall be repeated until 100 percent of the randomly selected I/O points have been demonstrated to meet specified end-to-end accuracy. Refer to Building Automation System Hardware Commissioning for additional detailed procedures. All additional costs incurred by the Engineer for commissioning checks of greater than 10% of I/O points shall be borne by the Temperature Controls Contractor.
  - 5. Demonstrate that all DDC and other software programs exist at respective field panels. The Direct Digital Control (DDC) programming and point database shall be as submitted and approved.
  - 6. Demonstrate that all DDC programs accomplish the specified sequences of operation.
  - 7. Demonstrate that the panels automatically recover from power failures, as specified.
  - 8. Demonstrate that all alarms are received at the appropriate workstations and maintenance personnel.
  - 9. Demonstrate that the stand-alone operation of panels meets the requirements of these Specifications. Demonstrate that the panels' response to LAN communication failures meets the requirements of these Specifications.
  - 10. Identify access to equipment selected by Owner's Representative/Engineer. Demonstrate that access is sufficient to perform required maintenance.
  - 11. Demonstrate "Web Browser" interface to ENGINEER at ENGINEER's office to show full functionality of system for web browser interface.
  - 12. Control System Demonstration shall be completed and approved prior to Substantial Completion.
- E. Coordinate Control System Demonstration requirements with training sessions described in Division 23 Section "Instrumentation and Control for HVAC."

#### 3.10 BUILDING AUTOMATION SYSTEM SOFTWARE COMMISSIONING

A. The Temperature Controls Contractor shall furnish the monitoring set-up package to the Owner/Engineer. The Temperature Controls Contractor shall coordinate and cooperate fully with the Owner/Engineer. Temperature Controls Contractor shall notify Owner/Engineer in writing, that the Building Automation System is ready for checkout.

Prior to this notification, Temperature Controls Contractor must provide the following items to the Owner/Engineer:

- 1. Building Automation System communication software and phone number or internet address per site.
- 2. Building control data files (all files required to review proposed load control and input interpretation). These will be files unique to each building and Building Automation System type. Data must be as current as possible (i.e., what's running in the building's BAS now). Up-to-date graphics files, if any, should be included.
- 3. Building Automation System operation and programming manuals.
- 4. Any hardware device(s) such as "Black Boxes", cables, switches, software, keys, etc., which are required to permit system communication/manipulation.
- 5. Control sequence flow charts. (These should be compared to submittal data to verify basic control instructions have been followed.)
- B. The Temperature Controls Contractor shall provide all the above items required for communicating with the Building Automation System to the Owner/Engineer as early as possible in the project. The Temperature Controls Contractor shall perform the software checkout before the hardware checkout. The Temperature Controls Contractor shall review programming strategies and techniques implemented thus far. In addition, the Temperature Controls Contractor shall provide to the Owner/Engineer all items required for the Owner/Engineer to do their own control programming independent of the Controls Contractor (Engineer may request read only access to the controls except for setpoint adjustment at the discretion of the Engineer).
- C. The Temperature Controls Contractor shall provide to the Owner/Engineer access to the Building Automation System via communications software to verify correct control sequence and set-up. The goal at this stage of the checkout is to evaluate the BAS programming. Compare implementation of control to that specified in the monitoring start-up package. The BAS graphics-based system must also be checked. (I.e. for an air handler, the graphics of the Air Handling Unit (AHU) and updated status information such as temperature, air flow, damper position and other details need confirmed. Graphics of floor plans with current temperatures also need checked.) BAS programming verification shall include, but not be limited to, the following:
  - Building Automation System Software Checkout Minimum Requirements The Temperature Controls Contractor shall provide access to software and all documentation so that the Owner's Representatives can witness the Temperature Controls Contractor performing the following key items during software commissioning:
    - a. Verify that all points listed in the specification are installed. Check that the point description match lists detailed in the specification and determine if there are better descriptions using Owner's terminology.
    - b. Control Limit: Check correct set points. Confirm type, i.e. a supervisory control point. Local thermostat and its setting(s) may also need to be considered. Determine if proportional adjustment of set point is available or specified.
    - c. Verify correct and accurate operation of proving switches. This would include, but not be limited to, flow switches, differential pressure switches, current transducers, and any other type of digital input.

- d. Alarm Limits: Verify that alarm limits, messages, and priorities are set per specifications. Determine if graphical system is correctly interfaced to Building Automation System. Graphical system should reflect correct system status and/or alarm system. Check that correct "Call out on alarm" phone numbers are specified.
- e. "Dead Band" and/or hysteresis specified values: Verify that they have been specified.
- f. Minimum or maximum ON/OFF period specified values: Verify that they have been specified.
- g. Pulse band specified values: Verify that they have been specified.
- h. ON/OFF message: Verify that it is specified, and if it is specified determine if it is appropriate. Determine if it's a user defined variable.
- Determine "actual" BAS output status indicated. This is the state of the relay, chip switch or other electronic switching device built into the Building Automation System controller, not the connected pilot relay, contactor, or other high current device.
- j. Determine if system provides a method to unconditionally override a point ON or OFF, and if this is accomplished via hardware (a connected input) or software. Determine if this condition can be incorporated into a trend or used to create an alarm.
- k. Controlling Schedule: Check for specification of occupied/unoccupied time. Find out if it agrees with the monitoring set-up package and if that has been assigned its own schedule or grouped with other loads. Decide if this point should be assigned to a "Group" for override/sequencing purposes.
- I. Optimal Start/Stop: Check specifications for optimal start/stop. Determine if a maximum start time has been established and if there is an optimal start cooling set point.
- m. For each output determines if output condition can be forced to a user-defined state via software.
- n. Check if sequencing to any other device is specified and whether it is logical (software) or actual (hard wired). (l.e. damper opens whenever the system has the associated fan ON (software) or when it sees the flow switch close (hardwired).
- o. Determine if point is being trend logged.
- p. Find out if trend log interval and range are specified.
- q. SET UP TREND LOGS. Verify that logged value is being compared to alarm limits. Runtime trend logs should be compared to industry standard maintenance intervals. Once limit is exceeded system should generate maintenance or savings related messages/reports. Analog trend data should be compared to projected and used to create alarm messages and savings reports.
- r. Check if logged value is being incorporated into a status report. If report is being created, then confirm that the report format is correct. Document where is report stored (i.e., central site workstation.)
- s. Check specifications for status report interval and phone numbers for remote storage of reports.
- t. Determine if local set control conditions are specified, and if default values used are for analog inputs, digital inputs, or digital outputs.
- u. Determine if "Local" override via a Hand/Off/Auto (HOA) switch or push button is specified, whether a time interval is specified, and if this input

condition is trended. If trended, determine if data is incorporated into a report. Also, check if override device is panel/PC board mounted or if it is remote to the controller. Examples: 1. Push button or twist timer located in zone served. 2. Switch that is part of BAS controller assembly. If override switch is part of controller determine if:

- 1) Its position is detectable by the BAS
- 2) Is position is tended.
- 3) It is programmed to create an alarm.
- 4) Its position history be incorporated in a report
- 5) Its position be ignored or overridden via software.
- v. Determine if "Local" temperature offset is specified. If yes, record this value.

# 3.11 CONTROL SYSTEM COMMISSIONING TESTING, ADJUSTING, CALIBRATION

- A. Work and/or systems installed under this Division shall be fully functioning prior to Demonstration, Acceptance Periods and Contract Close Out. Temperature Controls Contractor shall start, test, adjust, and calibrate all work and/or systems under this Contract and prepare a Control System Commissioning Report as described below:
  - 1. Verify proper electrical voltages and amperages and verify that all circuits are free from grounds or faults.
  - 2. Verify integrity/safety of all electrical connections.
  - 3. Verify proper interface with fire alarm system and smoke control sequence of operations.
  - 4. Test, calibrate, and set all digital and analog sensing, and actuating devices. Calibrate each instrumentation device by making a comparison between the Operator Interface display and the reading at the device, using an instrument traceable to the National Institute of Standards and Technology (NIST), which shall be at least twice as accurate as the device to be calibrated (i.e., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range). Record the measured value and displayed value for each device in the Control System Commissioning Report.
  - 5. Check and set zero and span adjustments for all actuating devices. Manually activate damper and valve operators to verify free travel and fail condition. Check valve or damper to ensure that it shuts off tight when the appropriate signal is applied to the operator. Adjust the operator spring compression as required. If positioner or volume booster is installed on the operator, calibrate per manufacturer's procedure to achieve spring range indicated. Check split range positioners to verify proper operation. Record settings for each device in the Control System Commissioning Report.
  - 6. Check each digital control point by making a comparison between the control command at the DPU and the status of the controlled device. Check each digital input point by making a comparison of the state of the sensing device and the Operator Interface display. Record the results for each device in the Control System Commissioning Report.
  - 7. Verify proper sequences by using the approved checklists to record results and submit with Control System Commissioning Report. Verify proper sequence and operation of all specified functions.
  - 8. Tune all control loops to obtain the fastest stable response without hunting, offset or overshoot. Record tuning parameters and response test results for each control

loop in the Control System Commissioning Report. Except from a startup, maximum allowable variance from set point for controlled variables shall be as follows:

- a. Air temperature: plus, or minus 0.5°F.
- b. Water temperature: plus, or minus 0.5°F for heating hot water.

# 3.12 DDC CONTROL SYSTEM (BAS) HARDWARE COMMISSIONING

- A. After ALL programming has been completed per approved specifications; notify the Owner/Engineer, and Balancing Contractor to schedule a time/date for a site visit.
- B. The Controls Contractor shall commission the BAS system while being witnessed at a minimum by Owner's Representative, Balancing Contractor, and the Engineer as the discretion of the Engineer. The Controls Contractor shall assist the Owner's Representative, other parties, and Balancing Contractor in double-checking selected points of installed Building Automation System in the following manner:
  - 1. The Controls Contractor will station one person at the main control computer or panel as directed by the Owner's Representative and/or Engineer. This person would be familiar with the BAS to facilitate reporting of temperatures and point status as indicated by the BAS. This person should also have a walkie-talkie for relaying this information to co-workers located at monitored points and controlled loads. Controls Contractor shall perform all hardware commissioning.
  - 2. The Controls Contractor shall check temperature sensor accuracy and calibrate, if required and requested by Owner/Engineer. If sensor calibration is needed, note required values (i.e., offset, gain, scaling). Verify sensor is not cross wired. Heat up sensor (use warmth of one's hand, NOT a flame) and use walkie-talkie to verify correct response is monitored at central computer or control panel.
  - 3. Check if sensor location provides accurate space temperature values. If sensor is used for zone control, note construction of surrounding area. Note the sensors ability to report a temperature that is representative of the "Zone". (I.e. is sensor affected by exposure to large glass surfaces, outside or hallway doors, heat producing equipment or near a copier or coffee maker.) In general, note differences in building construction material used in a newly renovated area when compared to the original structure. Relocate sensor if required for more representative reading after notifying and obtaining the approval of the Engineer/Owner's Representative at no additional cost to the Owner.
  - 4. Determine if the temperature sensor's location match that specified in the specifications or on the floor plan of the approved relocation point. Check if a guard (sensor subject to abuse) or sun shield (outside) is required and provide them when required and approved by the Engineer/Owner's Representative at no additional cost to the Owner.
  - 5. Check any zone override switches, such as whether it is push button or twist timer, the correct location specified on floor plans, and if its condition is correctly reported back to Building Automation System.
  - 6. Inspect Building Automation System installation.
    - a. Check workmanship for being on par with Owner's Representative/Engineers standards.
    - b. Wiring bundles should be organized and routed in an orderly fashion.
    - c. Input and output wires should be clearly labeled.

- d. Labels should follow names/terminology specified in specifications, job drawings, or the monitoring set-up package.
- e. All wires should terminate securely.
- f. Panel mounted H-O-A's, if present, shall be labeled.
- g. Record controller jumpers or switch positions.
- h. Routing of Building Automation System communication line(s) should be noted on "as-built" floor plan.
- i. If control panel can be locked verify that Owner has keys.
- j. Verify Building Automation System wiring documentation is in each panel.
- k. Check if a 110 Volt AC outlet is in or near the control panel.
- I. Check if power line for Building Automation System or phone line surge suppression is provided.
- m. Check if the Building Automation System has its own power circuit/breaker and determine and note its location.
- 7. Make punch list as checkout progresses. Record questionable/problem items on a punch list for reference during follow-up checkout. Submit punch list to the Engineer and Owner's Representative when requested.
- 8. Verify outputs and their connected loads operate correctly.
  - a. Via Building Automation System, place building in night mode. If sensed space temperatures are not below the unoccupied set point, then all the controlled loads should be off. This should provide a quick method for the first stage of the initial checkout.
  - b. In addition to the above, all the following steps must also be checked:
    - 1) Load cycle ON/OFF via Building Automation System HOA.
    - 2) Load cycle ON/OFF via Building Automation System software control.
    - 3) Displayed Building Automation System status must agree with actual load conditions. (I.e., when the BAS controlled point {EP, relay, contractor, and damper} is active, does the connected load respond in a correct manner?)
- 9. Damper Control:
  - a. Verify that dampers are truly in the position indicated by the Building Automation System. If the BAS shows 100%, the dampers must be closed. If the BAS shows 25% opened dampers, then the dampers should be approximately 25%, and so on.
- 10. Building Automation System Central Site Computer Check-Out:
  - a. Provide the physical location for all building BAS computers and type. The following steps should be performed for all Central Site Computers (CSC).
    - 1) Record the brand, serial number, and model number of the CSC. Record configuration and hard drive capacity. Record modem brand, model number and serial port being used for connection. If a printer is available, note the brand and model number.
    - 2) Determine if the system is used for programs other than the programs required for BAS call up.
    - 3) Note phone number for modem connected to Central Site Computers. If it is not a dedicated line, note the extension number.
    - 4) Provide the Owner with dated copies of all the above items.
- C. Training: Refer to Instrumentation and Control of HVAC Division 23 Section, "Close out Procedures" and General Mechanical and Electrical Requirements for additional information.

GSD-221-C

END OF SECTION 230993

#### SECTION 231123 - FACILITY NATURAL-GAS PIPING

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, tubes, and fittings.
  - 2. Piping specialties.
  - 3. Piping and tubing joining materials.
  - 4. Valves.
  - 5. Pressure regulators.

# 1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  - 1. Piping and Valves: 100 psig minimum unless otherwise indicated.
  - 2. Service Regulators: 100 psig minimum unless otherwise indicated.
  - 3. Minimum Operating Pressure of Service Meter: 30 psig.
- B. Natural-Gas System Pressure within Buildings: 14 inch. W.C

#### 1.4 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Piping specialties.
  - 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  - 3. Pressure regulators. Indicate pressure ratings and capacities.
  - 4. Dielectric fittings.
- B. Field quality-control reports.

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C. Operation and Maintenance Data: For motorized gas valves, pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support 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.
- 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.

#### 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
  - 1. Notify Engineer/Architect and Owner no fewer than three (3) days in advance of proposed interruption of natural-gas service.
  - 2. Do not proceed with interruption of natural-gas service without Architect/Engineer's and Owner's written permission.

#### PART 2 - PRODUCTS

# 2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum orings, and spiral-wound metal gaskets.

- e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
- B. PE Pipe: ASTM D2513, SDR 11.5.
  - 1. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type with dimensions matching PE pipe.
  - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11.5; and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
  - 3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D2513, SDR 11.5 inlet.
    - b. Casing: Steel pipe complying with ASTM A53/A53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet is threaded or flanged or suitable for welded connection.
    - e. Tracer wire connection.
    - f. UV shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  - 4. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Suitable for joining PE pipe to PE pipe.
    - a. PE body with molded-in, stainless steel support ring.
    - b. Seals: NBR.
    - c. Acetal collets.
    - d. Electro-zinc-plated steel stiffener.
  - 5. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Suitable for joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    - a. Fiber-reinforced plastic body.
    - b. PE body tube.
    - c. Seals: NBR.
    - d. Acetal collets.
    - e. Stainless steel bolts, nuts, and washers.
  - 6. Steel Mechanical Couplings: Suitable for joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    - a. Stainless steel flanges and tube with epoxy finish.
    - b. Seals: NBR.
    - c. Stainless steel bolts, washers, and nuts.
    - d. Factory-installed anode for steel-body couplings installed underground.

# 2.2 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

### 2.3 MANUAL GAS SHUTOFF VALVES

- A. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
  - 1. CWP Rating: 125 psig.
  - 2. Threaded Ends: Comply with ASME B1.20.1.
  - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  - 4. Tamperproof Feature: Locking feature for valves.
  - 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
  - 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- B. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
  - 1. CWP Rating: 125 psig.
  - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  - 3. Tamperproof Feature: Locking feature for valves.
  - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
  - 5. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- C. Bronze Plug Valves: MSS SP-78.
  - 1. Body: Bronze, complying with ASTM B 584.
  - 2. Plug: Bronze.
  - 3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  - 4. Operator: Square head or lug type with tamperproof feature where indicated.
  - 5. Pressure Class: 125 psig.
  - 6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  - 7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

## 2.4 PRESSURE REGULATORS

- A. General Requirements:
  - 1. Single stage and suitable for natural gas.
  - 2. Steel jacket and corrosion-resistant components.
  - 3. Elevation compensator.
  - 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Service Pressure Regulators: Comply with ANSI Z21.80.
  - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  - 2. Springs: Zinc-plated steel; interchangeable.

- 3. Diaphragm Plate: Zinc-plated steel.
- 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
- 5. Orifice: Aluminum; interchangeable.
- 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
- 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
- 9. Overpressure Protection Device: Factory mounted on pressure regulator.
- 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
- 11. Maximum Inlet Pressure: 100 psig.
- C. Line Pressure Regulators: Comply with ANSI Z21.80.
  - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
  - 2. Springs: Zinc-plated steel; interchangeable.
  - 3. Diaphragm Plate: Zinc-plated steel.
  - 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
  - 5. Orifice: Aluminum; interchangeable.
  - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
  - 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
  - 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
  - 9. Overpressure Protection Device: Factory mounted on pressure regulator.
  - 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
  - 11. Maximum Inlet Pressure: 5 psig.

## 2.5 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. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.

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- c. Pressure Rating: 125 psig
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

# D. Dielectric-Flange Insulating Kits:

- 1. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: 150 psig.
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

### PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 requirements for prevention of accidental ignition.

### 3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Underground natural-gas piping is to be the following:
  - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
- C. Steel Piping with Protective Coating:
  - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
  - 2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
  - 3. Replace pipe having damaged PE coating with new pipe.

D. Install fittings for changes in direction and branch connections.

## 3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- B. Aboveground, distribution piping is to be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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.
- D. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- E. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- F. 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.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- H. Locate valves for easy access.
- I. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.
- L. Verify final equipment locations for roughing-in.
- M. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- N. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

- O. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- P. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- Q. Concealed Location Installations:
  - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
  - 2. Prohibited Locations:
    - Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- R. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- S. Connect branch piping from top or side of horizontal piping.
- T. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- U. Do not use natural-gas piping as grounding electrode.
- V. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- W. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 22 Section "Meters and Gages for HVAC".
- X. Install sleeves and sleeve seals for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for HVAC Piping."
- Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Piping."

# 3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance.
- B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

# 3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

## C. Threaded Joints:

- 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
- 2. Cut threads full and clean using sharp dies.
- 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
- 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
- 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

## D. Welded Joints:

- 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
- 2. Bevel plain ends of steel pipe.
- 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

# 3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
  - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
  - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
  - 5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

# 3.8 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

## 3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 22 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

### 3.10 PAINTING

- A. Paint exposed, exterior metal piping, vent piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel flat.
    - d. Color: Yellow.
- B. Paint exposed, interior metal piping, vent piping, valves, service regulators, service meters and meter bars, and piping specialties, except components, with factory-applied paint or protective coating.
  - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
    - a. Prime Coat: Quick-drying alkyd metal primer.
    - b. Intermediate Coat: Interior latex matching topcoat.
    - c. Topcoat: Interior latex eggshell.
    - d. Color: Yellow.
- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

## 3.11 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having jurisdiction.

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- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

# 3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:
  - 1. Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:
  - 1. Bronze plug valve.
- C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:
  - 1. Bronze plug valve.
- D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:
  - 1. Bronze plug valve.

**END OF SECTION 231123** 

### SECTION 232113 - HYDRONIC PIPING

### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Hot-water heating piping.
  - 2. Condensate-drain piping.
  - 3. Air-vent piping.
  - 4. Safety-valve-inlet and -outlet piping.

### 1.3 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Pipe, fittings and joining materials.
  - Chemical treatment.

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
  - Installers of Pressure-Sealed Joints: Installers shall be certified by pressure-seal joint manufacturer as having been trained and qualified to join piping with pressureseal pipe couplings and fittings.
- B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- C. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

- 1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
- 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

## 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. Hot-Water Heating Piping: 125 psig at 200 deg F.
  - 2. Condensate-Drain Piping: 150 deg F.
  - 3. Makeup-Water Piping: 150 psig at 73 deg F.
  - 4. Air-Vent Piping: 200 deg F.
  - 5. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

# 2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. Copper Pressure-Seal-Joint 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:
    - a. Elkhart Products Corporation.
    - b. NIBCO Inc.
    - c. <u>Viega.</u>
  - 2. Housing: Copper.
  - 3. O-Rings and Pipe Stops: EPDM.
  - 4. Tools: Manufacturer's special tools.
  - 5. Minimum 200-psig working-pressure rating at 250 deg F
  - 6. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 7. Minimum 200-psig working-pressure rating at 250 deg F.
- D. Wrought-Copper Unions: ASME B16.22.

# 2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- D. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- E. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- F. Grooved Mechanical-Joint Fittings and Couplings:
  - 1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
  - 2. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
- G. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

## 2.4 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. 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.
- E. 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.

F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

### 2.5 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. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 150 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig minimum at 180 deg F.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Description:
    - Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
  - 1. Description:
    - a. Standard: IAPMO PS 66.
    - b. Electroplated steel nipple, complying with ASTM F 1545.
    - c. Pressure Rating: 300 psig at 225 deg F.
    - d. End Connections: Male threaded or grooved.
    - e. Lining: Inert and noncorrosive, propylene.

## 2.6 BYPASS CHEMICAL FEEDER

A. Description: Welded steel construction; 125-psig working pressure; 5-gal. capacity; with fill funnel and inlet, outlet, and drain valves. Coordinate requirements with the Owner's existing chemical treatment vendor.

1. Chemicals: Specially formulated, based on analysis of makeup water, to prevent accumulation of scale and corrosion in piping and connected equipment.

### PART 3 - EXECUTION

## 3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed or pressure-seal joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
  - 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Makeup-water piping installed aboveground shall be the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered or brazed joints.
- D. Condensate-Drain Piping: DWV copper pipe and fittings and soldered joints.
- E. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- F. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
  - 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- G. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-metal transition fittings for piping systems according to piping manufacturer's written instructions.

### 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. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap and chain, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe. Mechanically formed or "Extruded Tees" are not acceptable.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment".

- U. Install sleeves and sleeve seals for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves and sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for 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 unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

## 3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment" 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 and/or pipe stands as required.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet.
  - 2. NPS 1: Maximum span, 7 feet.
  - 3. NPS 1-1/2: Maximum span, 9 feet.
  - 4. NPS 2: Maximum span, 10 feet.
  - 5. NPS 2-1/2: Maximum span, 11 feet.
  - 6. NPS 3 and Larger: Maximum span, 12 feet.
- D. Install hangers for drawn-temper 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.
- 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. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- H. Mechanically Formed Tees are not permitted.
- I. Pressure-Sealed Joints: Use manufacturer-recommended tool and procedure. Leave insertion marks on pipe after assembly.

## 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping and valves shall be full size (minimum of NPS ¾) as indicated on the drawings to the point of connection to equipment. Reductions in piping size shall only occur at equipment connections to match the connection size.
- B. Install control valves in accessible locations close to connected equipment.

C. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Division 23 Section "Meters and Gages for HVAC Piping."

### 3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure, or 100 psig, whichever is greater. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  - 5. After hydrostatic test pressure has been applied for at least 60 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  - 6. Prepare written report of testing.
- C. Perform the following before operating the system:
  - 1. Open manual valves fully.
  - 2. Inspect pumps for proper rotation.
  - 3. Set makeup pressure-reducing valves for required system pressure.
  - 4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  - 5. Set temperature controls so all coils are calling for full flow.
  - 6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  - 7. Verify lubrication of motors and bearings.

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END OF SECTION 232113

### SECTION 232113.13 - UNDERGROUND HYDRONIC PIPING

### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

A. Heating Hot Water Pre-engineered Piping System.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. All piping system components.
- B. Shop Drawings: For underground hydronic piping.
  - 1. Include calculations showing requirements for expansion compensation for underground piping.
  - 2. Show expansion compensators, offsets, and loops with appropriate materials to allow piping movement at required locations. Show anchors and guides that restrain piping movement with calculated loads, and show concrete thrust block dimensions.
  - 3. Show pipe sizes, locations, inverts, and pitch. Show piping in trench, piping in conduit, and cased pipe with details showing clearances between piping.
  - 4. Show insulation thickness.
- C. Delegated-Design Submittal: For underground hydronic piping systems indicated to comply with performance requirements and design criteria, including analysis data and design drawings signed and sealed by the professional engineer responsible for their preparation.
  - Include design calculations and details for selecting thermal expansion and thrust restraints.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from hydronic distribution piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and at vertical scale of not less than 1 inch equals 5 feet.
  - 1. Show locations and inverts of utility system piping. Show types, sizes, materials, and inverts of other utilities crossing hydronic piping.
  - 2. Show depth of cover from top of hydronic system pipes to finished grade.
- C. Welding certificates.
- D. Material Test Reports: For piping, by a qualified testing agency.
- E. Source quality-control reports.
- F. Field quality-control reports.

## 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with ASME Boiler and Pressure Vessel Code: Section IX.
  - 1. Comply with provisions in ASME B31.9, "Building Services Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

### 1.6 FIELD CONDITIONS

- A. Interruption of Existing Utilities: Do not interrupt utilities serving occupied facilities unless permitted under the following conditions and then only after arranging to provide temporary utility services in accordance with requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
  - 2. Do not proceed with interruption of utility without Owner's written permission.

## 1.7 COORDINATION

A. Coordinate pipe-fitting pressure classes with products specified in related Sections.

### PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. All underground hot water piping (less than 250 Deg. F) shall be the POLY-THERM type, as manufactured by PERMA-PIPE or Owner and/or Engineer approved equal. All straight sections, fittings, and other accessories shall be factory fabricated to job dimensions and designed to minimize the number of field welds. Each system layout shall be computer analyzed by the piping system manufacturer to determine stress on the carrier pipe and anticipated thermal movement of the service pipe. The system design shall be in strict conformance with ANSI B31.1, latest edition. Factory trained field technical assistance shall be provided for critical periods of installation, unloading, field joint instruction and testing.
- B. DESIGN CONDITIONS The system shall conform to the following design conditions. Calculations shall be provided with the bid proposal to assure the system meets the conditions of this specification. The Heating Hot Water pipe shall be designed for 125 PSIG pressure at 200 Deg. F. The system shall have an overall heat loss not to exceed SEE BELOW. Calculations shall be based on; ground temperature of 40 Deg. F., 4'-0" average depth of cover, soil thermal conductivity of 12 (Btu-in./hr.-ft.\*\*2-F).
  - 1. Heating Hot Water 125 PSIG pressure at 200 Degrees F. Heat Loss = 57.5 Btu/hr-ft.
- C. SERVICE PIPE Internal piping shall be ASTM A53, Grade B, Schedule 40, ERW carbon steel pipe. All joints shall be butt-welded. Where possible, straight sections shall be supplied in 20-foot random lengths with piping exposed at each end for field joint fabrication.
- D. ACCESSORIES End seals and shall be designed and factory fabricated to prevent the ingress of moisture into the system.
- E. INSULATION The service pipe insulation shall be polyurethane foam with 2 lb/ft³ minimum density, 90% minimum closed cell content, minimum compressive strength of 40 psi and initial thermal conductivity of 0.18 Btu in/hr/ft² /deg. F. The insulation shall completely fill the annular space between the service pipe and jacket and-shall be bonded to both. Systems using open cell insulation, or a non- bonded design shall not be allowed. The polyurethane foam insulation shall be tested by the manufacturer for mechanical and thermal to assure compliance with the above values. All test samples will be taken from production material, identified, tagged and tested in accordance with the information below. Test reports showing results will be furnished to the engineer for approval. Data supplied by the polyurethane foam chemical supplier is not acceptable.
  - 1. Insulation Density, ASTM STD D 1622, Sample Frequency at once per shift, 2 lb/ft<sup>3</sup> required.
  - 2. Insulation Compression Strength, ASTM STD D 1621, Sample Frequency at once per shift, 40 psi minimum.
  - 3. Insulation Closed Cell Content, ASTM STD D 2856, Sample Frequency at once per shift, 90% minimum.

- 4. Insulation Thermal Conductivity, ASTM STD C 518, Sample Frequency at once per shift, less than 0.18 Btu-in/hr/ft²/°F.
- 5. Service pipe insulation shall be 1" thick for all piping.
- F. PROTECTIVE JACKET An aluminum diffusion barrier shall be applied on the outside of the insulation before application of the outer jacket. The barrier shall prevent the diffusion of the blowing agent out of the foam to prevent the foam from aging. The diffusion barrier shall be of composite construction with a minimum 12 micron aluminum layer sandwiched between two layers of polyethylene each a minimum of 50 microns thick. The polyethylene layers shall be corona treated to guarantee bonding between the foam insulation and the outer jacket."All straight sections of the insulated piping system shall be filament wound, polyester resin/fiberglass reinforcement composite directly applied on the insulating foam. The minimum thickness for FRP jacket shall be .085 inches. Thermoplastic casing material, e.g. PVC or PE shall not be allowed.
- G. FITTINGS All fittings of the insulated piping system shall be prefabricated to minimize field joints and jacketed in a chopped spray-up, polyester resin/fiberglass reinforcement composite, directly applied onto the insulating foam to a thickness related to the filament wound jacket thickness.

### PART 3 - EXECUTION

## 3.1 EARTHWORK

A. See Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

## 3.2 PIPING APPLICATION

- A. Hot-Water Heating Piping:
  - 1. All underground hot water piping (less than 250 Deg. F) shall be the POLY-THERM type, as manufactured by PERMA-PIPE or Owner and/or Engineer approved equal. All straight sections, fittings, and other accessories shall be factory fabricated to job dimensions and designed to minimize the number of field welds. Each system layout shall be computer analyzed by the piping system manufacturer to determine stress on the carrier pipe and anticipated thermal movement of the service pipe. The system design shall be in strict conformance with ANSI B31.1, latest edition. Factory trained field technical assistance shall be provided for critical periods of installation; unloading, field joint instruction and testing.

# 3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such 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 coordination drawings.

- B. Remove standing water in the bottom of trench.
- C. BACKFILL A 4-inch layer of sand or fine gravel shall be placed and tamped in the trench to provide a uniform bedding for the system. The entire trench shall be evenly backfilled with a similar material as the bedding in 6-inch compacted layers to a minimum height of 6 inches above the top of the insulated piping system. The remaining trench shall be evenly and continuously backfilled in uniform layers with suitable excavated soil.
- D. Do not backfill piping trench until field quality-control testing has been completed and results approved.
- E. Install piping at uniform grade of 0.2 percent. Install required fittings to accommodate capped drains at low points and elsewhere as required for system drainage. Install capped manual air vents at high points.
  - 1. Maintain continuous bedding under piping. Do not leave gaps in pipe bedding, allowing pipe to sag between contact points with the bedding.
- F. In conduits, install drain valves at low points and manual air vents at high points.
- G. Install components with pressure rating equal to or greater than system operating pressure.
- H. Install piping in straight lines. Do not bend pipe.
- I. Install fittings for changes in direction and branch connections.
- J. FIELD JOINTS The installing contractor shall handle the system in accordance with the directions furnished by the manufacturer and as approved by the architect and engineer. The internal pipe shall be hydrostatically tested to 150 psig or 1 1/2 times the operating pressure, whichever is greater. Insulation shall then be poured in place into the field weld area. All field-applied insulation shall be placed only in straight sections. Field insulation of fittings shall not be acceptable. The mold for the polyurethane shall be a light gauge aluminum material. The installer shall seal the field joint area with a heat shrinkable adhesive backed wrap. Backfilling shall not begin until the heat shrink wrap has cooled. All insulation and coating materials for making the field joint shall be furnished by the pipe manufacturer.
- K. See Section 230517 "Sleeves and Sleeve Seals for HVAC Piping" for sleeves and mechanical sleeve seals through exterior building walls.
- L. Secure anchors with concrete thrust blocks. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- M. Connect to hydronic piping where it passes through the building wall. Hydronic piping inside the building is specified in Section 232113 "Hydronic Piping."
- N. Secure anchors and fittings where piping changes direction, and where elsewhere required by manufacturer's written installation instructions, with concrete thrust blocks. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

- O. Apply bitumastic coating to carbon-steel anchors and guides. Pour concrete thrust blocks and anchors. See Section 033000 "Cast-in-Place Concrete" for concrete and reinforcement.
- P. After field quality-control testing is complete, backfill with 6 inches of clean, granular material in accordance with piping system manufacturer's written instructions. If mechanical compaction is required, manually backfill to 12 inches before using mechanical-compaction equipment.

### 3.4 IDENTIFICATION

A. Install continuous plastic underground warning tapes during backfilling of trenches for underground hydronic piping. Locate tapes 6 to 8 inches below finished grade, directly over piping. See Section 312000 "Earth Moving" for warning-tape materials and devices and their installation.

### 3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections

# B. Tests and Inspections:

- 1. Prepare hydronic piping for testing in accordance with ASME B31.9 and as follows:
  - a. Leave joints, including welds, uninsulated and exposed for examination during test.
  - b. Isolate equipment and instrumentation. Do not subject equipment and instrumentation to test pressure.
  - c. Install relief valve set to relieve at pressure no more than one-third higher than test pressure.
  - d. Fill system with water. Where there is risk of freezing, perform testing with air or liquid that will not freeze or cause damage to piping system materials.
  - e. For hydrostatic testing, install vents at high points to release trapped air while filling system. Remove test liquid at accessible low points.
- 2. Test hydronic piping as follows:
  - a. Subject hydronic piping to hydrostatic test pressure that is not less than 1.5 times system design pressure.
  - b. After hydrostatic test pressure has been applied for 10 minutes, examine joints for leakage. Remake leaking joints using new materials and repeat hydrostatic test until no leaks exist.
  - c. Do not pressurize carrier pipe with air.
  - d. Maintain test pressure for two hours with no loss of pressure.
- 3. Test conduit as follows:
  - a. Seal vents and drains and subject conduit to 15-psig compressed air for four hours with no loss of pressure. Repair leaks and retest.
- C. Piping will be considered defective if it does not pass tests and inspections.

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- D. Prepare test and inspection reports.
- E. When successful testing is complete, flush carrier piping to remove dirt or debris remaining after construction. Drain piping after flushing is complete.
- F. Fill underground piping system with permanent system liquid prior to system testing and balancing.

**END OF SECTION 232113.13** 

### SECTION 232116 - HYDRONIC PIPING SPECIALTIES

### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
  - 1. Hot-water heating piping.
  - 2. Air-vent piping.

### 1.3 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 2. Air-control devices.
  - 3. Hydronic specialties.
- B. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter Kit: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

## 1.5 QUALITY ASSURANCE

A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

### 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. Hot-water heating piping: 125 psig at 200 deg F.
  - 2. Air-Vent Piping: 200 deg F.
  - 3. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

# 2.2 VALVES

- A. Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping.
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section "Instrumentation and Control for HVAC.
- C. Calibrated-Orifice, Balancing Valves:
  - 1. Balancing valve shall have bronze or cast-iron body. Valves to have differential pressure readout ports across valve seat area with integral check valves. Valve shall be equipped with memory stop. Valves to have threaded ends for sizes 2" and less, flanged ends for larger sizes. Valve to be provided with pre-formed molded insulation casing. Design working pressure and temperature to be 200 psi at 250 degrees F and balancing valve shall be like Bell & Gossett Model CB or Nexus Ultra MB Model MBF. Provide with balancing valves, one (1) water gpm readout kit to be turned over to Owner which shall include a differential pressure meter with full scale overrange protection, hoses, readout probes, filters, carry case and calculator.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump.
    - c. Flow Design Inc.
  - 3. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  - 4. Ball: Brass or stainless steel.
  - 5. Plug: Resin.
  - 6. Seat: PTFE.
  - 7. End Connections: Threaded or socket.
  - 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  - 9. Handle Style: Lever, with memory stop to retain set position.

- 10. Rating: Minimum 125 psig.
- 11. Maximum Operating Temperature: 250 deg F.
- D. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
    - a. Armstrong Pumps, Inc.
    - b. Bell & Gossett Domestic Pump.
    - c. Flow Design Inc.
  - 2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
  - 3. Ball: Brass or stainless steel.
  - 4. Stem Seals: EPDM O-rings.
  - 5. Disc: Glass and carbon-filled PTFE.
  - 6. Seat: PTFE.
  - 7. End Connections: Flanged or grooved.
  - 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  - 9. Handle Style: Lever, with memory stop to retain set position.
  - 10. Rating: Minimum 125 psig.
  - 11. Maximum Operating Temperature: 250 deg F.
- E. Pump Drops: Factory assembled grooved end pump drops. Assemble is installation-ready with flexible couplings to accommodate vibration attenuation and stress relief rated for 300 PSI. Victaulic Series, 380, 381, 385.

## 2.3 AIR-CONTROL DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:
  - 1. Amtrol. Inc.
  - 2. Armstrong Pumps, IncArmstrong Pumps, Inc.
  - 3. Bell & Gossett Domestic PumpBell & Gossett Domestic Pump.
- B. Manual Air Vents:
  - 1. Body: Bronze.
  - Internal Parts: Nonferrous.
  - 3. Operator: Screwdriver or thumbscrew.
  - 4. Inlet Connection: NPS 1/2.
  - 5. Discharge Connection: NPS 1/8.
  - 6. Rating: 150 psig.
  - 7. Maximum Operating Temperature: 225 deg F.
- C. Automatic Air Vents: Equal to Bell & Gossett Model 107A high capacity float actuated automatic air vent with cast iron body and bonnet. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Pipe discharge to nearest floor drain unless noted otherwise.

- 1. Body: Bronze or cast iron.
- 2. Internal Parts: Nonferrous.
- 3. Operator: Noncorrosive metal float.
- 4. Inlet Connection: NPS 1/2.
- 5. Discharge Connection: NPS 1/4.
- 6. Rating: 150 psig.
- 7. Maximum Operating Temperature: 240 deg F.
- D. Manual Air Vent: Equal to Bell & Gossett Model 78 manual air vent with cast brass body and built-in check valve. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Install with 12" length of 1/4" soft copper discharge piping unless noted otherwise.

## 2.4 HYDRONIC PIPING SPECIALTIES

## A. Y-Pattern Strainers:

- 1. (2" and under): Equal to Nibco T-221-A Series "Y" type strainer with bronze body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug, blow down valves, and be rated for 200 psi working pressure.
- 2. (2½" and larger) equal to Watts 77F Series "Y" type strainer with semi-steel body and flanged ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with bolted cleanout, blow down valves and be rated for 200 psi working pressure
- 3. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
- 4. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
- 5. Strainer Screen: Stainless-steel, 40-mesh strainer, or perforated stainless-steel basket.
- 6. Rating: 125 psig.

## B. Stainless-Steel Bellow, Flexible Connectors:

- 1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
- 2. End Connections: Threaded or flanged to match equipment connected.
- 3. Performance: Capable of 3/4-inch misalignment.
- 4. Rating: 150 psig.
- 5. Maximum Operating Temperature: 250 deg F.

## C. Spherical, Rubber, Flexible Connectors:

- 1. Body: Fiber-reinforced rubber body.
- 2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
- 3. Performance: Capable of misalignment.
- 4. Rating: 150 psig.
- 5. Maximum Operating Temperature: 250 deg F.

### PART 3 - EXECUTION

# 3.1 VALVE APPLICATIONS

- A. Install shut off-duty ball valves at each branch connection to supply mains and at supply connection to each piece of equipment, unless only one piece of equipment is connected in the branch line.
- B. Install throttling-duty ball valves at each branch connection to return mains, at return connections to each piece of equipment and elsewhere as indicated.
- C. Install calibrated-orifice, balancing valves in the return pipe of each cooling element and elsewhere as required to facilitate system balancing.
- D. Install check valves where required to control flow direction.

## 3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at air-handling unit coils, and elsewhere as required for system air venting.
- B. Install flexible connections at points of connection to equipment.
- C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual air vents at air-handling unit coils and elsewhere as required for air venting.
- D. Vent and purge air from hydronic system and ensure that existing expansion tanks are properly charged with air to suit system Project requirements.

**END OF SECTION 232116** 

### SECTION 232123 - HYDRONIC PUMPS

### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section Includes:
  - 1. Close-coupled, in-line centrifugal pumps.

### 1.3 SUBMITTALS

- A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.
- B. Shop Drawings: For each pump.
  - 1. Show pump layout and connections.
  - 2. Include setting drawings with templates for installing structural mounting steel and other anchorages.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

## 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Mechanical Seals: One mechanical seal(s) for each pump.

## PART 2 - PRODUCTS

# 2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Source Limitations: Obtain pumps from single source from single manufacturer. Subject to compliance with requirements, provide product indicated on drawings or comparable product by one of the following:
  - 1. Armstrong Pumps
  - 2. Grundfos, Basis of Design
  - 3. Bell and Gossett
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

# C. Pump Construction:

- Casing: Radially split, cast iron, ASTM class 35 with threaded gauge tappings at inlet and outlet and threaded companion-flange connections. Cast iron parts shall have an epoxy-based coating made in a cathodic electro-deposition (CED) process. CED is a high quality dip-painting process where an electrical field around the products ensures deposition of paint particles as a thin, well-controlled layer on the surface.
- 2. Impeller: Composite, PES+30% GF; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
- 3. Pump Stub Shaft: Type 304 stainless steel.
- 4. Seal: Mechanical seal consisting of silicon carbide rotating ring against a silicon carbide seat held by a stainless steel spring, and EPDM rubber secondary seal. Include water slinger on shaft between motor and seal.
- 5. Seal Flushing: Flush, cool, and lubricate pump seal by directing pump discharge water to flow over the seal.
- D. Motor: Comply with IEC 60034 designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
  - 1. Enclosure: Totally enclosed, fan cooled.
  - 2. IE5 Ultra Premium Efficient motors as defined in IEC 60034.
  - 3. 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.
  - 4. Terminal Box: Terminal box holds terminals for the following connections.
    - a. One dedicated digital input.
    - b. Two analog inputs, 0(4)-20 mA, 0-10V.
    - c. One configurable digital input or open-collector output.
    - d. Grundfos combined temperature and differential pressure sensor (separate connected).
    - e. 24V voltage supply for sensors.
    - f. Two signal relay outputs (potential-free contacts).

- a. GENIbus connection.
- h. Interface for Grundfos CIM fieldbus module.
- 5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
- 6. Variable-speed motor.
- 7. Provide integral pump motor variable-speed controller.
- Pump is fitted with a combined temperature-and differential pressure sensor, built in PI controller, and operating panel with display. Communication with the pump is possible by means of Grundfos GO Remote. The remote control feature enable further settings as well as reading out a number of parameters such as "Actual value", "Speed", "Power Input" and total "Power consumption". Pump has the following available control modes: AUTOADAPT: This function continuously adjusts the proportional-pressure curve and automatically sets a more efficient curve without compromising comfort demands. FLOWADAPT. This control mode combines AUTOADAPT with a flow-limiting function. The pump continuously monitors the flow rate to ensure the desired maximum flow is not exceeded. This will save the cost of a separate pump-throttling valve. Constant differential pressure. The pump head is kept constant, independent of the flow of the system. Proportional pressure. The head of the pump will increase proportionally to the flow in the system to compensate for the large pressure losses in the distribution pipes. Constant Temperature. The return-pipe temperature is kept constant. Note: If the pump is installed in the flow pipe, an external temperature sensor must be installed in the return pipe of the system. Constant differential temperature. The differential temperature can be measured by a differential-temperature sensor or two separate temperature sensors. Constant curve. The pump can be set to run at a constant speed in the range of 25% to 100% of the maximum speed.

## 2.2 PUMP SPECIALTY FITTINGS

### A. Suction Diffuser:

- 1. Angle pattern.
- 2. 175-psig pressure rating, cast-iron body and end cap, pump-inlet fitting.
- 3. Bronze startup and bronze or stainless-steel permanent strainers.
- 4. Bronze or stainless-steel straightening vanes.
- 5. Drain plug.
- 6. Factory-fabricated support.

### PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine overhead structural steel locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PUMP INSTALLATION

- A. Comply with Hydraulic Institute (HI) 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and elastomeric hangers of size required to support weight of in-line pumps.
  - 1. Comply with requirements for vibration/restraint devices specified in Division 20 "Vibration Controls for Piping and Equipment."
  - 2. Comply with requirements for hangers and supports specified in Division 20 "Hangers and Supports for Piping and Equipment."

## 3.3 CONNECTIONS

- A. Where installing piping adjacent to pump, allow space for service and maintenance.
- B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- D. Install Y-type strainer and suction diffuser and shutoff valve on suction side of pumps.
- E. Install flexible connectors on suction and discharge sides of pumps between pump casing and valves.
- F. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

## 3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Check piping connections for tightness.
  - Clean strainers on suction piping.
  - 4. Perform the following startup checks for each pump before starting:
    - a. Verify bearing lubrication.

- b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
- c. Verify that pump is rotating in the correct direction.
- 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
- 6. Start motor.
- 7. Open discharge valve slowly.

## 3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

**END OF SECTION 232123** 

### SECTION 232500 - HVAC WATER TREATMENT

### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. Division 23 Hydronic Piping applies to and forms a part of this section.
- D. General notes on all drawings apply to and form a part of the Specifications.

### 1.2 SUMMARY

- A. Section includes the following HVAC water-treatment for Closed Systems:
  - Mechanical Contractor shall chemically clean and flush new piping Mechanical contractor shall furnish temporary circulator and temporary power for cleaning process and circulation of during filling.
  - 2. Manual and automatic chemical-feed equipment and controls.
  - 3. Chemical treatment test equipment.
  - Chemicals.

## 1.3 DEFINITIONS

- A. EEPROM: Electrically erasable, programmable read-only memory.
- B. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

## 1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified. Include manufacturer's technical product data, furnished specialties, accessories, and installation and startup instructions.
- C. Field test reports indicating and interpreting test results relative to compliance with specified requirements.

- D. Maintenance data to include in the operation and maintenance manual specified in Division 1. Include detailed manufacturer's instructions.
- E. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:
  - 1. Chemical test equipment.
  - 2. Chemical material safety data sheets.
  - 3. Shot Filter Feeder. Equal to Neptune FTF-5DB provided by Mechanical Contractor.
- F. Shop Drawings: Chemical treatment equipment showing tanks, maintenance space required, and piping connections to HVAC systems.
- G. Include plans, elevations, sections, and attachment details:
  - 1. Include diagrams for power and control wiring.
- H. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider. Water Treatment Provider must also have a Certified Water Technologist as Certified by the "Association of Water Technologies".
- I. Field quality-control reports.
- J. Other Informational Submittals:
  - 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.
  - 2. Water Analysis: Illustrate water quality available at Project site.
- K. Operation and Maintenance Data: For sensors and controllers to include in emergency, operation, and maintenance manuals.

# 1.5 QUALITY ASSURANCE

- A. Supplier Qualifications: A recognized chemical water treatment supplier with warehousing facilities in the Project's vicinity and that is, or employs, an experienced consultant, available at reasonable times to consult with Contractor, Engineer, and Owner about water treatment.
- B. Chemical Standards: Meet state and local pollution-control regulations.
- C. Comply with NFPA 70 for components and installation.
- D. Listing and Labeling: Provide products specified in this Section that are listed and labeled:
  - 1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

E. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

# 1.6 SERVICE PERIOD

- A. Provide chemicals and service program for period of one year from Substantial Completion date and including the following:
  - 1. Initial analysis of Project site water and systems after they have initially filled with water
  - 2. Cleaning and Pre-cleaning of the Systems including flushing before final filling with inhibitor.
  - 3. A full report discussing cleaning protocols and all analyses.
  - 4. Initial water-based system inhibitor report.
  - 5. Startup assistance.
  - 6. Training of operating personnel.
  - 7. Periodic field service and consultation.
  - 8. Laboratory technical assistance.

# PART 2 - PRODUCTS

# 2.1 ACCEPTABLE WATER TREATMENT SUPPLIERS

- A. Suppliers: Subject to compliance with requirements, provide products by one of the following or be preapproved by Engineer:
  - 1. GLA Water Consultants, Inc.
  - 2. <u>Artesian Process Chemical Group.</u>
  - 3. Anderson Chemical Company.
  - 4. General Electric Company; GE Water & Process Technologies.
  - 5. Nalco; an Ecolab company.

# 2.2 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or to the environment. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- B. Water quality minimum performance requirements for closed loops:
  - 1. Closed hydronic systems shall maintain a maximum pH value within 9 10.5 pH for iron and copper piping loops.
  - 2. Total Anaerobic Plate County Maintain a maximum value of 100 organisms/ml.

- 3. Nitrate Reducers (Denitrifying Bacteria) Maintain below a maximum value of 10,000 organisms/ml.
- 4. Sulfate Reducers Maintain below a maximum value of 200 organisms/ml.
- 5. Iron Bacteria Maintain below a maximum value of 100 organisms/ml.
- 6. Slime Bacteria Maintain below a maximum value of 1,000 organisms/ml.
- C. The precleaning and flushing of the systems must be done with the oversight of the water treatment provider. It must also be documented in a formal report supplied to the general contractor and project engineer, documenting the steps taken during precleaning and flushing, the water analyses done during each of the steps and a final flushing water quality analysis with particle size distribution analyses being conducted on the final flush water.
- D. The formal report shall also document the quality of the treated system. The quality of the treated water must meet the specifications set forth by the HVAC equipment manufacturer, if there are any. If no such specifications exist for the equipment, a full analysis must be done including a particle size distribution analyses, that documents the quality of the water/fluid.

# 2.3 BYPASS FILTER/MANUAL CHEMICAL-FEED EQUIPMENT (PROVIDED BY MC)

- A. Bypass Filter Feeders: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch (89-mm) fill opening in the top, and NPS 3/4 (DN 20) bottom inlet and top side outlet. Feeder shall have a stainless-steel dissolving basket that fully supports the filter bag. The filter bag shall be the 1-micron type with ring top and handle. The feeder shall have only a threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel. The filter feeder shall be similar to Neptune model FTF-5DB:
  - 1. Capacity: 5 gal.
  - 2. Working Pressure: 125 psig.

# 2.4 CHEMICAL TREATMENT TEST EQUIPMENT

- A. System Cleaner: The system cleaner must be able to clean piping in the system. It must be able to clean new piping of mill scale and oil and debris. This Cleaner must contain emulsifying agents, chelating agents, passivating agents, polymeric dispersants, iron corrosion by-product removal agents and detergents to remove grease and petroleum products:
  - 1. Ferroquest by GE Betz or SC-101 as manufactured by Glycol Technologies.
- B. Closed System (Water) Chemicals: Only those products that comply with Section 2.5.
- C. Test Kit: Manufacturer-recommended equipment and chemicals in a test case for testing pH, inhibitor, alkalinity, and hardness.

# 2.5 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.
- B. Hydrotest Inhibitor: All Hydrotest Water shall contain a corrosion inhibitor package and biocide to protect the system from corrosion and biological growth during stagnant periods or draining. This inhibitor package must be added during all hydrotesting. NOTE: VERIFY THAT HYDROTESTING INHIBITOR PACKAGE IS COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM. THIS MUST BE DONE BY THE WATER TREATMENT PROVIDER.
- C. System Cleaner: As recommended by the water treatment provider and system manufacturer to remove grease and petroleum products, flash rusting agents and other particulate in the system. NOTE: VERIFY THAT SYSTEM CLEANER IS COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM. THIS MUST BE DONE BY THE WATER TREATMENT PROVIDER.
- D. Closed Loop, Water Piping Chemicals: As recommended by the water treatment provider and system manufacturer to reduce deposits, inhibit corrosion and control biological growth. It also must comply with the system water quality performance requirements specified in this Section. This product is for use during the time between flushing and filling addition to keep the system from corroding and from bacteria from growing. NOTE: VERIFY THAT SYSTEM CORROSION INHIBITORS AND BIOCIDE ARE COMPATIBLE WITH THE EQUIPMENT ON THE SYSTEM. THIS MUST BE DONE BY THE WATER TREATMENT PROVIDER.

#### PART 3 - EXECUTION

# 3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.
- B. Perform an inspection of the piping system and identify all metallurgies utilized.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.
  - 2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
  - 3. Do not enclose, cover, or put piping into operation until it is tested, and satisfactory test results are achieved.
  - 4. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

- 5. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
- 6. 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 test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
- 7. Repair leaks and defects with new materials and retest piping until no leaks exist.

# 3.2 CLEANING AND FLUSHING OF HYDRONIC PIPING

- A. This project consists of hydronic piping for building boiler loop. There are several precautions which must be observed during piping installation. This Contractor is advised to read all the manufacturer's instruction prior to commencing the installation.
- B. All water circulating systems for the project shall be thoroughly cleaned before placing in operation to ride the system of dirt, piping compound, ill scale, oil and any and all other material foreign to the water. During construction, extreme care shall be exercised to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting or valve shall be visually examined, and all dirt removed.
- C. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris; repair damaged finishes, including chips, scratches, and abrasions.
- D. When initially filling the systems for cleaning, the water used for filling shall be metered. Ensure that system is operational, filled, started, and vented prior to cleaning. When draining the system after cleaning and flushing, the amount of water removed shall be metered and compared to the initial metered fill volume to determine how much trapped water remains in the systems.
- E. Perform the following procedure for cleaning, flushing and filling the piping systems:
  - 1. After the piping is complete:
    - a. The Contractor shall first fill the piping loops and all runouts with clear water. The loop water shall be circulated for one hour with make-up water open and drain open to accomplish initial flushing of the system.
    - b. After initial flushing, all strainers shall be cleaned and the individual terminal devices and coils shall be connected permanently to the supply and return runouts conditions and then add trisodium phosphate in an aqueous solution to the system at the proportion on one pound per fifty gallons of water in the system.
    - c. After the system is filled with this solution, the loop shall be allowed to circulate for 24 hours.
    - d. The Chemical Treatment Contractor shall be given notice by the Contractor of scheduling this cleaning and, if the Owner's Representative deems it necessary, the operation shall be repeated.

- e. After the system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable method and shall be left on the slightly alkaline side.
- f. If the system is found to be still on the acid side, the cleaning by use of Trisodium Phosphate shall be repeated.
- g. After the cleaning, including all strainers and flushing is complete, and approved by the Owner's Representative, the Contractor shall provide the proper water treatment for the system.

# 2. Closed Loop Chemical Treatment:

- a. Use the MC furnished and install combination side stream bypass filter and chemical feeder for injection of the closed loop chemicals into the system.
- b. Flushing of the system should be done after the bag filter is clean. While circulating Inject fresh city water while draining a portion of water to drain keeping the pressures in the system constant continue flushing until no foaming is evident and the water runs clear. Also, check the conductivity and the conductivity should be the same as the city water make-up.
- c. Heat the cleaning solution to the temperature recommended by the Water Treatment Provider. If this temperature is not practical, heat the water to the highest possible temperature.
- d. After the system is complete, it shall be thoroughly cleaned before placing in operation to rid the system of dirt, biological contamination, piping compound, loose mill scale, oil and any and all other material foreign to the water as previously specified.
- e. Before chemical cleaning and sterilization or the entire system, the hydronic loop and mains shall be individually flushed and purged until free of dirt, debris and air. During the flushing/purging and chemical cleaning processes the supply and return run-out shall be temporarily placed in bypass operation. Refer to System Filling & Purging Plan for additional information.
- f. Circulate the cleaning solution for 60 minutes then test the parameters as set forth by the Water Treatment Provider. Continue circulating and testing until the cleaning solution reaches the parameters provided. Utilize the bag filter to determine when the system is fully cleaned. The bag filters must come out visibly clean for two successive 24-hour cycles before the system is considered clean. This should be judged by the Water Treatment Provider.
- g. Refill the piping system with fresh water with all air bleeds in the open position to remove all air from the system. Add cleaner to the piping system as recommended by the Water Treatment Provider to achieve the recommended concentration.
- h. After chemical cleaning, the entire system shall be sterilized with a biocide added at recommended dosage to effectively kill any present microorganisms. Add glutaraldehyde to achieve 60 200 ppm of active ingredient or isothiazoline to achieve 10 13 pp, active. Do not flush biocide from the system. Corrosion inhibitors shall be installed in closed loop systems containing metal piping, fittings, accessories, etc.
- i. A bacteria analysis shall be performed to ascertain cleanliness of system. If bacteria counts are above set parameters, then sterilization process shall be repeated until the bacteria counts are at or below acceptable levels. Microbiological limits are listed under "Water Quality Minimum Performance Requirements" elsewhere in this section.

- j. Within 48 hours of the completion of the sterilization and confirmation that bio-levels are within the specified parameters, implement a water treatment program to passivate all metal surfaces.
- F. For the water side system chemically treat per the water treatment providers instructions.
- G. Once the system is cleaned and flushed, the Contractor shall inform the Engineer by means of a written letter. The letter shall state that the systems have been cleaned to the satisfaction of these specifications and manufacturers requirements.
- H. After all of this is done the water treatment provider must test the systems and provide a full written report.

# 3.3 INSTALLATION

- A. Through coordination with other Contractors, Vendors and Suppliers associated with this project, this Contractor shall ensure a complete, 100% functional, tested, inspected and approved systems. Claims for additional cost or change orders will immediately be rejected.
- B. Maintain a water treatment program for the closed loop piping systems. It is the Contractor's responsibility to contact the Engineer or Owner Representative 2 weeks in advance to any treatment performed on the systems. It is the Engineer's discretion whether or not this process should be monitored after notification.
- C. A preinstallation meeting shall be held with the Owner, Architect, Engineer, General Contractor, Mechanical Contractor, Pipe Fitter foreman, Geothermal Contractor and chemical Treatment Contractor to discuss goals and expectations for cleaning, flushing, purging and chemical treatment.
- D. Chemicals, equipment, testing services, and chemical application shall be supplied by a single water treatment company for undivided responsible. The water treatment company shall be a recognized specialist, active in the field of commercial/industrial water treatment for at least 5 years. The water treatment company shall have regional water analysis laboratories, service department and full-time representative located within a reasonable distance to the area of the job site or facility.
- E. Install chemical application equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. Anchor chemical tanks and floor-mounting accessories to substrate.
- F. All systems that are included in this specification should be filled the first time to determine the exact size of the system while using a water meter to determine the exact gallonage the system holds. All hydrotest water shall contain a corrosion inhibitor and biological treatment to protect the system from corrosion, flash rusting and biological growth during stagnant periods or draining. The size of the system shall be recorded and provided to the Water Treatment Provider and the project engineer.

- G. Prior to treating the system, thoroughly and completely clean the entire hot water systems of all dirt and debris. Cleaning shall consist of the following procedure:
  - 1. Step 1: Fill the closed loop system with hydrotest water. All hydrotest water shall contain a corrosion inhibitor to prevent corrosion and biological growth. If any portion of the system is subject to freezing temperatures at the time of the cleaning, postpone the cleaning procedure until weather permits or verify pumps can be kept continuously running during that time period.
  - 2. Step 2: Add cleaning chemicals in sufficient quantity as recommended by the water treatment provider.
  - 3. Step 3: Circulate solution throughout entire system for a minimum of 96-hours with filtration. Check bag filter every 24 hours to determine how dirty it is. Continue circulation until bag filter in filter feeder comes out clean.
  - 4. Step 4: Drain or flush the system until the cleaner is all removed from the system.
  - 5. Step 5: If the fluid being drained is dirty, repeat step 1 through step 4 until fluid being drained from system is clear. Take sample for laboratory analysis by the water treatment provider.
  - 6. Step 6: Fill the entire system with water and the corrosion inhibitor package.
  - 7. Step 7: Remove all air from system.
  - 8. Step 8: Add proper amount of chemicals as recommended by the water treatment provider to reduce deposits, inhibit corrosion, and bring the water quality within the specified limits as recommended by the water treatment provider.
  - 9. Circulate the system with filtration on-line to verify the system is clean. After 96-hours take a sample for laboratory analysis by the water treatment provider.
- H. Install water testing equipment near water chemical application equipment.
- I. Install interconnecting control wiring for chemical treatment controls and sensors.
- J. Install water-testing equipment on wall near water-chemical-application equipment.
- K. Mount sensors and injectors in piping circuits.
- L. Furnish initial supply of the closed loop chemicals for each system. The contractor shall retest the systems after 3, 6, 9 and 12 months upon substantial completion to verify the proper dosage is in each system. Provide all closed loop chemicals for the fire year. The Contractor shall determine the appropriate chemical volumes for each system. Each systems water shall be tested for proper chemical parameters, clarity, and biological activity. If needed, provide chemical addition. Provide any laboratory and technical assistance required to achieve a successful program.

# 3.4 BYPASS FILTER FEEDER INSTALLATION (BY MC)

- A. Install bypass filter feeders in closed hydronic system:
  - 1. Install full-port ball isolation valves on inlet, outlet, and drain below the feeder inlet.
  - 2. Install a swing check on the inlet after the isolation valve.
  - 3. Install site or flow sensor after filter housing.

# 3.5 CONNECTIONS

- A. Make piping connections between HVAC water-treatment equipment and dissimilarmetal piping with dielectric fittings. Dielectric fittings are specified in Section 232113 "Hydronic Piping."
- B. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."
- C. See Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.
- D. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

# 3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Equipment will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

# 3.7 MAINTENANCE SERVICE

- A. Verify with Owner that maintenance service is required for Project after warranty period is over and provide costs for Owner's consideration to continue maintenance service after warranty period is over.
- B. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:
  - 1. Initial water analysis and HVAC water-treatment recommendations.
  - 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
  - 3. Periodic field service and consultation.
  - 4. Customer report charts and log sheets.
  - 5. Laboratory technical analysis.

6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

#### 3.8 COMMISSIONING

A. Startup Services: Provide the services of a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.

# 3.9 DEMONSTRATION

- A. Provide services of supplier's technical representative for a minimum of one hour to instruct Owner's personnel in operation, maintenance, and testing procedures or longer as required to meet the Owner requirements. Obtain a sign off sheet showing attendance and acceptance of training by the Owner to be included as part of the O&M manuals and closeout documents (Refer to section 011001 for additional requirements.
- B. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- C. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance."
- D. As a condition of acceptance and project closeout, a summary of water quality and treatment shall be provided in writing to the Owner and/or Engineer after the water treatment services have been successfully completed. The closeout documentation shall include dates for warranty testing.

**END OF SECTION 232500** 

# SECTION 233113 - METAL DUCTS

#### PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

# A. Section Includes:

- 1. Single-wall rectangular ducts and fittings.
- 2. Sheet metal materials.
- 3. Sealants and gaskets.
- 4. Hangers and supports.

# B. Related Sections:

- 1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
- 2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
- 3. Division 23 Section "Duct Insulation" for duct insulation requirements.

# 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's "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's "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 SUBMITTALS

- A. Product Data: For each type of the following products:
  - 1. Sealants and gaskets.
  - 2. Sheet metal materials.

# B. Shop Drawings:

- 1. Factory- and shop-fabricated ducts and fittings.
- 2. Duct layout indicating sizes, configuration, elevations, liner material, and static-pressure classes.
- 3. Fittings.
- 4. Seam and joint construction.
- 5. Penetrations through fire-rated and other partitions.
- 6. Equipment installation based on equipment being used on Project.
- 7. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
- 8. Hangers and supports, including methods for duct and building attachment and vibration isolation.

# C. Delegated-Design Submittal:

- 1. Sheet metal thicknesses.
- 2. Joint and seam construction and sealing.
- 3. Reinforcement details and spacing.
- 4. Materials, fabrication, assembly, and spacing of hangers and supports.
- D. Field quality-control reports.

# 1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation."

# PART 2 - PRODUCTS

# 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "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's "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's "HVAC Duct Construction Standards Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "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's "HVAC Duct Construction Standards Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "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's "HVAC Duct Construction Standards - Metal and Flexible."

# 2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "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. Galvanized Coating Designation: G90.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- D. 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 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 smokedeveloped index of 50 when tested according to UL 723; certified by an NRTL.
- B. 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.
  - 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.

# C. 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. 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).
- 9. VOC: Maximum 395 g/L.
- 10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
- 11. Service: Indoor or outdoor.
- 12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. 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.
  - 6. 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).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
  - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inchand shall be rated for10-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.

# 2.4 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's "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 Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

# 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's "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. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

# 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. All exposed ductwork shall be painted. Color selection by Owner.
- C. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- D. 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.
- E. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- F. Repair or replace damaged sections and finished work that does not comply with these requirements.
- G. Prepare ductwork for painting where noted on drawings.

# 3.3 DUCT SEALING

- A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
  - 2. Outdoor, Supply-Air Ducts: Seal Class A.
  - 3. Outdoor, Exhaust Ducts: Seal Class B.
  - 4. Outdoor, Return-Air Ducts: Seal Class A.
  - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B unless noted higher on drawings.
  - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 7. Unconditioned Space, Exhaust Ducts: Seal Class B.
  - 8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B unless noted higher on drawings.
  - Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 11. Conditioned Space, Exhaust Ducts: Seal Class B.

12. Conditioned Space, Return-Air Ducts: Seal Class B unless noted higher on drawings.

#### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "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's "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 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's "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 galvanizedsteel primer. Paint materials and application requirements are specified in "Interior Painting."

# 3.7 AIR LEAKAGE TESTING OF THE DUCTWORK SYSTEMS

- A. The Mechanical Contractor shall hire an independent testing adjusting and balancing contractor to test ductwork if the ductwork system leakage exceeds the values as listed below or excess leakage is noted in the field and include all costs in their bid. Engineer/Owner's Representative shall randomly select areas to be tested and in the event the tested areas fail the Mechanical Contractor will be responsible for all testing costs including the engineer's time for retesting as required. A duct pre-installation conference shall be held prior to the installation of the ductwork. Present should be the Owner's Representative, Engineer, Test & Balance Contractor, General Contractor, Mechanical Contractor, Sheet Metal Contractor, Insulation Contractor and the manufacturer's representative of the duct sealant to be used. At this meeting, the contractor shall advise of the duct materials and sealant materials to be used to meet the air leakage allowances.
- B. Provide seven days' notice for testing.
- C. It is the intent of this section to insure the ductwork installed has minimal air leakage.
- D. Air leakage testing shall be accomplished by the Mechanical Contractor. At the contractor's option, they may hire the Testing, Adjusting and Balancing Contractor to perform this work.
- E. Do not insulate the duct systems prior to testing.
- F. The maximum allowable supply air (indoor and outdoor) leakage rate is 2.5% of the systems' design CFM when the ductwork is pressurized to 3" w.g. (Therefore, if a supply air system is tested, and the supply air fan rated capacity is 10,000 CFM, the allowable leakage is 250 CFM.)
- G. The maximum allowable return air (outdoor) air leakage rate is 2.5% of the system design when the ductwork is pressurized to 2" w.g.
- H. The Engineer shall randomly select supply ductwork, exhaust ductwork and return ductwork for testing. The selection of ducts shall be made the day of or the day before testing is to occur and shall be tested in the presence of an appointed witness to ensure the testing is properly conducted. If more than 10% of the tested ductwork fails, as determined by the Engineer, this will be cause for an additional sampling of 25% to be leakage tested at no additional cost to the Owner.
- I. The noted allowable leakage rate is the total allowable. It shall include leakage associated with the following:
  - 1. All ductwork as described in above paragraphs.
  - 2. Access doors.
  - 3. Volume dampers.
  - 4. Relief air doors.
  - 5. Fire dampers.
  - 6. End caps used to seal ducts.

- J. If any duct system fails a test, the contractor shall reseal the system. It shall then be retested until the duct system meets the allowable leakage rate at no additional cost to the Owner.
- K. Carefully select the ductwork construction requirements and the type of duct sealant to be used as required to meet the leakage allowances. The sheet metal duct pressure classification is a minimum only. The contractor shall select the appropriate sheet metal pressure classification, duct sealant class and duct sealant materials to meet the project's air leakage allowances.
- L. Whenever the systems are being leak tested, a representative from the Mechanical Contractor and Sheet Metal Contractor shall be present to assist.

# 3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Duct System Cleanliness:
  - 1. Ductwork shall be handled, stored, installed and protected in accordance with SMACNA's "Duct Cleanliness for New Construction Guidelines", Duct Cleanliness Level B (Intermediate Level).
  - 2. The Owner's Representative shall visually observe the duct system cleanliness to ensure that no visible contaminants are present. If it is determined through this observation that the ductwork cleanliness is not acceptable then the following shall be performed at no additional cost to the Owner:
    - a. Sections of the metal duct system shall be chosen randomly by the Owner's Representative, for cleanliness testing according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - b. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- C. Duct system will be considered defective if it does not pass the cleanliness testing and visual observation and the Duct Cleaning requirements under Article 3.9 will be required for all ductwork not passing the testing at no additional cost to the Owner.
- D. Prepare test and inspection reports.

# 3.9 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

# 3.10 DUCT PRESSURE SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Ducts:

- 1. Ducts downstream of supply fan:
  - a. Pressure Class: Positive 2-inch wg.
  - b. Minimum SMACNA Seal Class: B.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round and Flat Oval: 6.

# C. Return Ducts:

- 1. Ducts Connected to Equipment Not Listed Above:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round: 6.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
  - 1. Ducts Connected to boiler room supply fan:
    - a. Pressure Class: Positive or negative 2-inch wg.
    - b. Minimum SMACNA Seal Class: B.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.

# E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

# F. Elbow Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows", as indicated in the drawing details.
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio with splitter vane as indicated on the drawings.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. If mitered elbows are indicated on the drawings, use Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
- 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.
- G. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Spin in.
- 2. Round: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing ductwork.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical or bell mouth tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.
  - d. Notify Engineer immediately if supply, return or exhaust ductwork velocity exceeds 1500 fpm for verification of ductwork size prior to fabrication and installation for all low velocity applications. This excludes specialty exhaust systems.

**END OF SECTION 233113** 

# SECTION 233423 - HVAC POWER VENTILATORS

# PART 1 - GENERAL

# 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section Includes:
  - 1. In-line centrifugal fans

# 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on actual Project site elevations
- B. Operating Limits: Classify according to AMCA 99.

### 1.4 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. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

- C. Field quality-control reports.
- D. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.
- E. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

# 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.

#### PART 2 - PRODUCTS

# 2.1 IN-LINE CENTRIFUGAL FANS

- A. <u>Manufacturers:</u> 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. Aerovent; a division of Twin City Fan Companies, Ltd.
  - 2. Greenheck.
  - 3. Loren Cook Company.
  - 4. New York Blower Company (The).
- B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- C. Direct-Drive Units: ECM Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

### 2.2

### A. Accessories:

- 1. ECM Motor Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- 2. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
- 3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
- 4. Motorized Dampers: Parallel-blade dampers mounted in curb base with 24V electric actuator; wired to close when fan stops.

# 2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "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. Support suspended units from structure using threaded steel rods and elastomeric spring hangers with vertical-limit stops.
- D. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

# 3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

# 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Adjust belt tension.
  - 6. Adjust damper linkages for proper damper operation.
  - 7. Verify lubrication for bearings and other moving parts.
  - 8. Verify that manual in connected ductwork systems are in fully open position.
  - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 10. Shut unit down and reconnect automatic temperature-control operators.
  - 11. Remove and replace malfunctioning units and retest as specified above.
- C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- E. Prepare test and inspection reports.

# 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

# END OF SECTION 233423

# SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

#### PART 1 - GENERAL

#### 1.1 **RELATED DOCUMENTS**

- Α. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 – Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

#### **SUMMARY** 1.2

- Α. This Section includes the following:
  - 1. Listed double-wall vents and chimneys.

#### 1.3 **SUBMITTALS**

- Α. Product Data: For the following:
  - 1. Special gas vents.
  - Guy wires and connectors.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
- C. Welding certificates.
- D. Warranty: Special warranty specified in this Section.

#### 1.4 **QUALITY ASSURANCE**

- Α. Source Limitations: Obtain listed system components through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal SECTION 235100 - BREECHINGS, 235100 - 1

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Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.

C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

# PART 2 - PRODUCTS

# 2.1 LISTED SPECIAL GAS VENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Heat-Fab, Inc.
  - 2. Metal-Fab, Inc.
  - 3. <u>Selkirk Inc.; Selkirk Metalbestos and Air Mate.</u>
  - 4. Van Packer
- B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.
- C. Construction: Inner shell and outer jacket separated by at least a 1/2-inch airspace.
- D. Inner Shell: ASTM A 959, Type AL 29-4C stainless steel.
- E. Outer Jacket: Stainless steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, 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.
  - 1. Termination: tapered cone top designed to exclude rainfall.

# 2.2 GUYING AND BRACING MATERIALS

- A. Cable: Three galvanized, stranded wires of the following thickness:
  - 1. Minimum Size: 1/4 inch in diameter.
  - 2. For ID Sizes 4 to 15 Inches: 5/16 inch.
  - 3. For ID Sizes 18 to 24 Inches: 3/8 inch.
  - 4. For ID Sizes 27 to 30 Inches: 7/16 inch.
- B. Pipe: Three galvanized steel, NPS 1-1/4.
- C. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch.

# PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

# 3.2 APPLICATION

- A. Listed Special Gas Vent: Gas heating appliances.
- B. Field-Fabricated Metal Breechings and Chimneys: Steel pipe for use with engine exhaust.

# 3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Lap joints in direction of flow.

# 3.4 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

# **END OF SECTION 235100**

# SECTION 235216 - FIRE-TUBE CONDENSING BOILERS

# PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

A. This Section includes packaged, factory-fabricated and -assembled, gas-fired, fire-tube condensing boilers, trim, and accessories for heating hot water.

# 1.3 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Wiring Diagrams: Power, signal, and control wiring.
- C. Source quality-control test reports: Indicate and interpret test results for compliance with performance requirements before shipping.
- D. Field quality-control test reports: Indicate and interpret test results for compliance with performance requirements.
- E. Efficiency Data Points: Data shall be submitted per ASHRAE 155 Method of Testing for Rating Commercial Space Heating Boiler Systems. This data shall cover steady state thermal efficiency, part load efficiency, and idling energy input rate. Efficiency data not supported by a third party published test standard shall not be permitted.
- F. Warranty: Standard warranty specified in this Section.

# 1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

# 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: The manufacturer must have been involved in the manufacture of fire tube condensing hydronic boilers for no less than 5 years. The manufacturer must be headquartered in North America and manufacture in an ASME-certified facility wholly owned by the manufacturer. The specifying engineer, contractor and end customer must have the option to visit the factory to witness test fire and other relevant procedures.
- 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. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- D. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers Minimum Efficiency Requirements."
- E. AHRI Compliance: Boilers shall be AHRI listed and must meet the minimum efficiency specified under AHRI BTS-2000 as defined by Department of Energy in 10 CFR Part 431.
- F. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US and Canada. Boilers shall be tested in an ISO 17025 recognized laboratory. Boilers tested to UL 795 shall not be permitted.
  - 1. ANSI Z21.13 pertains to gas-fired low-pressure steam and hot water boilers. UL 795 pertains to commercial-industrial gas heating equipment.
- G. CSA Compliant: Boilers shall be compliant with CSA certification.

# 1.6 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.

# 1.7 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period for Fire-Tube Condensing Boilers:
  - a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship.
  - b. Heat exchangers/pressure vessel are warranted against thermal shock for the lifetime of the boiler.
  - c. The burner shall carry a five (5) year limited warranty against defective material or workmanship from the date of shipment.
  - d. All other components shall carry a one year limited warranty from date of boiler start up or 18 months from shipment if start up cannot be proven.

# PART 2 - PRODUCTS

# 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Lochinvar Crest Boiler as specified on Drawings. All others must be submitted by Voluntary alternate.
- B. Manufacturer shall have the capability to design, engineer, and build package systems for the above-mentioned boilers. These can include hydronic heating applications. Design of such systems shall be collaborative between the customer and the manufacturer.

# 2.2 CONSTRUCTION

- A. Description: Boiler shall be natural gas fired, fully condensing, and fire tube design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, fire-tube condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.
- B. Heat Exchanger: The heater exchanger shall bear the ASME "H" stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be constructed of a fully welded 316L stainless steel interior with a carbon steel shell and of fire tube design. Fire tube shall be of the Wave Fire Tube design and capable of transferring 16,000 to 20,000 Btu's per tube. The Wave Fire Tube shall be manufactured via a liquid impact process. The Wave Fire Tube shall have an OD = 1.654" and a wall thickness = 0.039". The top and bottom tubesheets shall have a minimum thickness = 3/8". There shall be no overlapping welds with the Wave Fire Tube to tubesheet welds. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. There shall be no banding material, bolts, gaskets or "O" rings in the heat exchanger design. Cast iron, aluminum, or copper tube or water tube boilers will not be accepted.
- C. Condensate Collection Basin: Fully welded 316L stainless steel.
- D. Intake Filter and Dirty Filter Switch: Boiler shall include an intake air filter with a factory installed air pressure switch. The pressure switch will alert the end user on the screen of the boiler that the intake filter is dirty and needs to be changed.

- E. Pressure Vessel: The pressure vessel shall be in accordance with ASME Section IV pressure vessel code. The pressure vessel shall be designed for a single-pass water flow to limit the water side pressure drop. Pressure drop shall be no greater than 6.5 psi at 180 gpm. The pressure vessel shall contain a volume of water no less than:
- F. Burner: Natural gas, forced draft single burner premix design. Operation of the burner shall not exceed that of 5.7% oxygen level or 40% excess air. The burner shall be high temperature stainless steel with a woven Fecralloy outer covering to provide modulating firing rates. The burner shall be capable of the stated gas train turndown without loss of combustion efficiency. The burner shall be removable from the boiler without removing the gas/air manifold. The burner shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet requirements of South Coast Air Quality Management District (SCAQMD) as compliant with Rule 1146.2 (FB 0751 FB 2001), Bay Area Quality Management District as compliant with Regulation 9 Rule 7 (FB 2501 FB 6001) and Texas Commission on Environmental Quality (FB 0751 FB 2001) as being compliant with Section 117.465.
- G. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.
  - 1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
- H. Gas Train: The boiler shall be supplied with two gas valves designed with negative pressure regulation and shall be capable of the following minimum turndowns:
- I. Ignition: Spark ignition with 100 percent main-valve shutoff with electronic flame supervision. Boilers using a pilot for ignition and/or UV scanners for flame supervision shall be deemed unacceptable.

# J. Casing:

- 1. Jacket: Heavy gauge primed and painted steel jacket with snap-in closures. Jacket panels shall be fully removal; the front door and side panels shall not require tools for removal. The jacket shall be mounted on a steel base with a minimum thickness = 1/4"
- 2. Control Compartment Enclosures: NEMA 250, Type 1A.
- 3. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
- 4. Combustion-Air Connections: Inlet and vent duct collars.
- 5. Clearances: Boilers shall feature zero (0) clearance to combustibles. Boilers shall have the ability to be placed side by side in multiples with no clearance in between if necessary. Local codes should be considered.
- K. Outdoor Capability: Manufacturer shall offer an outdoor certified boiler to allow outdoor installation in suitable climates.
- L. Rigging and Placement: Boiler shall include lifting lugs and fork truck accessibility for rigging.

# M. Characteristics and Capacities:

- 1. Heating Medium: Hot water.
- 2. Design Water Pressure Rating: 160 psi working pressure.
- 3. Safety Relief Valve Setting: 100 psig
- 4. Absolute Minimum Water Flow Rate: 50 GPM.

# N. Oxygen Sensor

1. An  $O_2$  sensor shall be offered as an optional package with this boiler. The  $O_2$  sensor shall be made by a top automotive supplier and is only available through Lochinvar. The  $O_2$  sensor shall be located in the combustion chamber. Boilers with  $O_2$  sensors placed elsewhere on the unit shall not be permitted.

### 2.3 TRIM

# A. Safety Relief Valve:

- 1. Size and Capacity: 100 lb.
  - a. System pressures should be confirmed.
  - b. Custom relief valve sizes can be ordered.
- 2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.
- B. Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.
- C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.
- D. Condensate Trap: Factory supplied condensate trap with condensate trip sensor.
  - 1. Install condensate trap outlet piping to factory provided condensate acid neutralization tank. Install condensate piping from neutralization tank to floor drain.

# 2.4 CONTROLS

- A. Refer to Division 23 Section "Instrumentation and Control for HVAC."
- B. Boiler controls shall feature the following standard features:
  - 8" LCD screen display displaying status, modulation percentage, setpoints, and sensor data at a minimum on the home screen. Additional information such as history and parameters can be accessed via the touchscreen display without the need for navigation buttons. A screen saver mode shall be available with the display.
  - 2. Variable Speed Boiler Pump Control: Boiler may be programmed to send a 0-10V DC output signal to an ECM or VFD boiler pump to maintain a designed temperature rise across the heat exchanger. The boiler shall be able to operate in this mode with a minimum temperature rise of 20 degrees F and a maximum

- temperature rise of 60 degrees F. Project specific temperature rise shall be as shown on drawings.
- 3. Password Security: Boiler shall have a different password security code for the User and the Installer to access adjustable parameters.
- 4. Outdoor air reset: Boiler shall calculate the set point using a field installed, factory supplied outdoor sensor and an adjustable reset curve.
- 5. Pump exercise: Boiler shall energize any pump it controls for an adjustable time if the associated pump has been off for a time period of 24 hours.
- 6. Ramp delay: Boiler may be programmed to limit the firing rate based on six limits steps and six time intervals.
- 7. Boost function: Boiler may be programmed to automatically increase the set point a fixed number of degrees (adjustable by installer) if the setpoint has been continuously active for a set period of time (time adjustable by installer). This process will continue until the space heating demand ends.
- 8. PC port connection: Boiler shall have a PC port allowing the connection of PC boiler software.
- 9. Time clock: Boiler shall have an internal time clock with the ability to time and date stamp lock-out codes and maintain records of runtime.
- 10. Service reminder: Boiler shall have the ability to display a yellow colored service notification screen based upon months of installation, hours of operation, and number of boiler cycles. All notifications are adjustable by the installer.
- 11. Three pump Pump control: Boiler shall have the ability to control the boiler pump, pump and the domestic hot water system pump.
- 12. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
- 13. Night setback: Boiler may be programmed to reduce the space heating temperature set point during a certain time of the day.
- 14. Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.
- 15. Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.
- 16. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.
- 17. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, hours running and ignition attempts and should be able to view on boiler screen.
- C. The boiler shall have a built in Cascade controller to sequence and rotate lead boiler to ensure equal runtime while maintaining modulation of up to 8 boilers of different btu inputs without utilization of an external controller. The factory installed, internal cascade controller shall include:
  - 1. Lead lag: The Control module shall minimize the number of boilers firing to achieve the heating load.

- 2. Efficiency optimization: The Control module shall allow multiple boilers to fire at minimum firing rate in lieu of Lead/Lag.
- 3. Front end loading: The Control modulate shall have the ability to communicate with other Lochinvar boilers featuring the SmartTouch™ and Smart System™ control platforms. This allows for a combination of units that feature condensing and noncondensing operation if so desired.
- 4. Rotation of lead boiler: The Control module shall change the lead boiler every hour for the first 24 hours after initializing the Cascade. Following that, the leader will be changed once every 24 hours.
- 5. Redundancy: The Control module shall have a built in feature to continue operating with follow boilers if the Lead boiler is not operational.
- D. Boiler operating controls shall include the following devices and features:
  - 1. Set-Point Adjust: Set points shall be adjustable.
  - 2. Operating Pressure Control: Factory wired and mounted to cycle burner.
  - 3. Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
  - 4. Sequence of Operation: Electric, factory-fabricated and factory-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.
- E. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
  - 1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
  - 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
  - 3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
  - 4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
  - 5. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
  - 6. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.
  - 7. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for any lockout conditions.
- F. Building Automation System Interface: Factory installed Modbus and BACnet MSTP gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.
  - 1. BACnet IP and LonWorks gateways are available as optional equipment.

- G. Software Update: The control shall have the ability to receive updates in the field without hardware component replacement. This update can be performed via USB flash drive, internet connection, or via wireless connection. This service shall be provided at no additional and/or annual cost to the owner.
- H. CON•X•US Remote Connect: Integral remote connectivity technology that allows a mobile device to monitor and control boiler functionality. Internet connection is available on the Crest via Wi-Fi or hardwired Ethernet connection. This service shall be provided at no additional and/or annual cost to the owner.
- I. RealTime O₂ Feedback™: Boiler, if equipped with the optional RealTime O₂ Feedback™ package, shall provide real time sensing of O₂. Free air calibration of the sensor shall occur after every combustion cycle. The O₂ value shall also auto correct for conditions such as altitude. O₂ information shall be displayed in real time via a gauge on both the boiler touchscreen as well as the CON•X•US Remote Connect screen.

# 2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.
- B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
- C. Electrical Characteristics:
  - 1. See Drawings
  - 2. Voltage
    - a. 480V/3PH FB 4001 through 6001
  - 3. Frequency: 60 Hz
  - 4. Provide and install factory supplied 208V/3PH transformers to supply 480V/3PH power to boilers.

# 2.6 VENTING

- A. Exhaust flue for the FB 5001 FB 6001 must be UL listed, Category IV approved stainless steel sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.
- B. Intake piping for all models must be of approved material as listed in the Installation and Operations manual. Boilers intake pipe length must be able to extend to 100 equivalent feet.
- C. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

- D. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.
- E. Boilers using common venting must contact the factory for sizing.
- F. Refer to manufacturer's Installation and Operations manual for detailed venting instructions and approved manufacturers.

## 2.7 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- C. Allow Owner access to source quality-control testing of boilers. Notify Engineer 14 days in advance of testing.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for concrete equipment bases, anchorbolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
  - 1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in of piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 BOILER INSTALLATION

- A. Install equipment on 4" concrete housekeeping pad.
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.

## 3.3 CONNECTIONS

- A. Install boilers level on concrete bases. Concrete base is specified in Division 23 Section "Common Work Results for HVAC," and concrete materials and installation requirements are specified in Division 03.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to factory provided acid neutralization tank. Install condensate piping from acid neutralization tank to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of equipment connection. Provide a reducer if required. Gas regulator shall also be installed per IOM. Manufacturer shall offer a 2 and 5 psi gas regulator offering for each boiler model.
- E. Connect hot-water piping to supply and return boiler tappings with shutoff valve and union or flange at each connection.
- F. Install piping from safety relief valves to nearest floor drain.
- G. Boiler Venting:
  - 1. Install flue venting kit and combustion-air intake.
  - 2. Connect full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys, and Stacks.
- H. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- I. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 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.
- B. Tests and Inspections:
  - 1. Perform installation and startup checks according to manufacturer's written instructions. Complete startup form included with Boiler and return to Manufacturer as described in the instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.

- 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
  - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Occupancy Adjustments: When requested within 12 months of 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.

## D. Performance Tests:

- 1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
- 2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
- 3. Perform field performance tests to determine capacity and efficiency of boilers.
- 4. Repeat tests until results comply with requirements indicated.
- 5. Provide analysis equipment required to determine performance.
- 6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
- 7. Notify Engineer in advance of test dates.
- 8. Perform a combustion analysis after installation and adjust gas valve per the Installation and Operations manual and note in startup report.
- 9. Document test results in a report and submit to Architect.

#### 3.5 DEMONSTRATION

A. Engage a factory representative or a factory-authorized service representative for boiler startup and to train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Division 01 Section "Demonstration and Training."

**END OF SECTION 235216** 

## SECTION 238239.16 - PROPELLER UNIT HEATERS

#### PART 1 - RELATED DOCUMENTS

## 1.1 GENERAL

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUMMARY

A. Section includes propeller unit heaters with hot-water coils.

## 1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. PTFE: Polytetrafluoroethylene plastic.
- C. TFE: Tetrafluoroethylene plastic.

#### 1.4 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.
- 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 location and size of each field connection.
- 4. Include details of anchorages and attachments to structure and to supported equipment.
- 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
- 6. Indicate location and arrangement of piping valves and specialties.

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## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which propeller unit heaters will be attached.
  - 3. Size and location of initial access modules for acoustical tile.
- B. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following or approved equal,
  - 1. Trane
  - 2. Modine
  - 3. Sterling

## 2.2 DESCRIPTION

- A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.
- 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 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

## 2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

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**HEATERS** 

- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- C. Discharge Louver: Adjustable fin diffuser for horizontal units.

## 2.5 COILS

- A. General Coil Requirements: Test and rate hot-water propeller unit-heater coils according to ASHRAE 33.
- B. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.

## 2.6 FAN AND MOTOR

- A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- B. Motor: Permanently lubricated, . Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and 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 propeller unit heaters to comply with NFPA 90A.
- B. Install propeller unit heaters level and plumb.
- C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

## 3.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties. Piping installation requirements are specified in the following Sections:
  - 1. Section 232113 "Hydronic Piping."
  - 2. Section 232116 "Hydronic Piping Specialties."
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to propeller unit heater's factory, hot-water piping package. Install the piping package if shipped loose.
- D. Comply with safety requirements in UL 1995.
- E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of propeller unit heater. Hydronic specialties are specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties."
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

**END OF SECTION 238239.16** 

# DIVISION 26 ELECTRICAL

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## PART 2 - PRODUCTS

## 2.1 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

## 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.

## 2.3 SYSTEM DESCRIPTION

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.

#### PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.
- C. Unless otherwise proposed by Contractor and accepted by Engineer.

## 3.2 CONDUCTOR INSULATION AND WIRING METHODS

- A. Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- B. Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.

#### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Complete raceway installation between conductor and cable termination points according to Division 26 Section "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- 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.

## 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than non-spliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

## 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.

## 3.6 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

**END OF SECTION 260519** 

#### SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 SUBMITTALS

- A. Field quality-control reports.
- B. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
    - a. Instructions for periodic testing and inspection of grounding features based on NETA MTS and NFPA 70B.
      - Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
      - 2) Include recommended testing intervals.

## 1.3 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. 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 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 wide and 1/16 inch thick.
- 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.2 CONNECTORS

- A. Listed and labeled by an NRTL 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.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression and exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 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. 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

## 3.2 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.
- 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.

## 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. 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 bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

# 3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

- D. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
  - 5. Substations and Pad-Mounted Equipment: 5 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.
- F. END OF SECTION 260526

END OF SECTION 260526

## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. 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.

## 1.3 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- B. Comply with NFPA 70.

# 1.4 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of equipment supports and roof penetrations.

## 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. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 4. 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 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. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of 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, zinc-coated or 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. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following
      - 1) <u>Cooper B-Line, Inc.; a division of Cooper Industries.</u>
      - 2) Hilti Inc.
      - 3) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 4) 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.

## 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 and RMC as required by 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 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.
- 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 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 New Concrete: Bolt to concrete inserts.
  - 2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 3. To Existing Concrete: Expansion anchor fasteners.
  - 4. 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.
  - 5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 6. To Light Steel: Sheet metal screws.
  - 7. 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. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- B. 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 "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 9 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 260529** 

## SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## PART 2 - PRODUCTS

## 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Setscrew.
  - 2. Expansion Fittings: Match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

## 2.2 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep 4 inches by 2-1/8 inches by 2-1/8 inches deep.

## PART 3 - EXECUTION

## 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Conduit, Aboveground: GRC.
  - 2. Underground Conduit: RNC, Type EPC-80-PVC.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed and Subject to Physical Damage: GRC. Raceway locations include the following:
    - a. Mechanical rooms.
  - 2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  - 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: GRC.
  - 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. EMT: Use setscrew, steel or cast-metal fittings. Comply with NEMA FB 2.10.
  - 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings or where approved by Owner's Representative.

## 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

## P. Surface Raceways:

- 1. Install surface raceway with a minimum 2-inch radius control at bend points.
- 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- Q. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a similar finish to adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- R. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- S. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

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- T. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- U. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- V. Locate boxes so that cover or plate will not span different building finishes.
- W. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- X. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Y. Set metal floor boxes level and flush with finished floor surface.

## 3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Division 07 "Penetration Firestopping."

## 3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

**END OF SECTION 260533** 

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

## 1.3 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- 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 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

## 2.2 CONDUCTOR 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. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted or write-on, as applicable or noted, 3-mil-thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.

## 2.3 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.
- B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.4 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.

4. Color: Black except where used for color-coding.

## 2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. 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 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 signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

## 3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label or self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.

- B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with black indelible marker with the panel-board ID, circuit number(s) and system voltage.
- C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
    - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
    - d. 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.
- D. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal 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 the Operation and Maintenance Manual.
- G. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install in finished spaces.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.
  - 1. Comply with 29 CFR 1910.145.

- 2. Identify system voltage with black letters on an orange background.
- 3. Apply to exterior of door, cover, or other access.
- 4. For 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.
- Operating Instruction Signs: 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.
- J. Emergency Operating Instruction Signs: 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.
- K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the 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 two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label or stenciled legend 4 inchesgh.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  - 2. Equipment to Be Labeled:
    - Panel-boards: Typewritten directory of circuits in the location provided by panel-board manufacturer. Panel-board identification shall be engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Switchgear.
    - e. Switchboards.
    - f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panel-boards or equipment supplied by the secondary.
    - g. Emergency system boxes and enclosures.
    - h. Enclosed switches.
    - i. Enclosed circuit breakers.
    - j. Enclosed controllers.
    - k. Variable-speed controllers.
    - Push-button stations.

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- m. Power transfer equipment.n. Contactors.

END OF SECTION 260553

## SECTION 260800 - COMMISSIONING OF ELECTRICAL SYSTEMS

## PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

## 1.2 WORK INCLUDED

- A. Systems and equipment Start-Up and Functional Performance Testing.
- B. Validation of proper and thorough installation of Division 26 systems and equipment.
- C. Generic Start-Up Documentation for electrical systems and equipment.
- D. Development of final Start-Up Documentation for electrical systems and equipment.
- E. System Start-Up and Turn-Over procedures.
- F. Coordination and execution of Training Events.

#### 1.3 GENERAL DESCRIPTION

- A. Commissioning (Cx) is the process of ensuring that all building systems are installed and perform interactively according to the design intent; that systems are efficient and cost effective and meet the Owner's operational needs; that the installation is adequately documented; and that the Operators are adequately trained. It serves as a tool to minimize post-occupancy operational problems. It establishes testing and communication protocols to advance the building systems from installation to full dynamic operation and optimization.
- B. Commissioning Authority (CxA) shall work with the Contractor and the design engineers to direct and oversee the Cx process and perform Functional Performance Testing.
- C. This Section outlines the Cx procedures specific to the Division 26 Contractors. Requirements common to all Sections are specified in Sections 019113, 019114 and 019115 (Cx Plan).

## 1.4 SCOPE

- A. The following systems and equipment are included in the Scope of Commissioning for this project:
  - 1. All electrical work related to new HVAC equipment.
  - 2. Lighting Controls.
  - 3. Fire Alarm devices limited to interface items with HVAC (All locations).

## 1.5 RELATED WORK AND DOCUMENTS

- A. Section 019113 General Commissioning Requirements: details the Cx requirements common across all divisions.
- B. Section 019114 Functional Performance Testing Procedures: Outlines the generic functional testing procedures required.
- C. Section 019115 Commissioning Plan including preliminary Pre-Functional and Functional Performance Testing Procedures: Outlines the initial Commissioning Plan including pre-functional and functional testing procedures required.
- D. Individual Specification Sections: Individual sections stipulate installation, start-up, warranty, O&M documentation, and training requirements for the system or device specified in the Section.
- E. Section 230800 Mechanical Systems Commissioning: Details the commissioning procedures specific to Division 23 work.

## 1.6 DEFINITIONS AND ABBREVIATIONS

A. Refer to Section 019113

## 1.7 REFERENCE STANDARDS

- A. National Electric Code (NEC)
- B. American Society for Testing and Materials (ASTM)
- C. Electronics Industry Association/Telecommunications Industry Association (EIA/TIA)
- D. Illuminating Engineering Society (IES)
- E. Institute of Electrical and Electronics Engineers (IEEE)
- F. InterNational Electrical Testing Association (NETA)
- G. National Electrical Manufacturers Associates (NEMA)
- H. National Fire Protection Association (NFPA)
  SECTION 260800 COMMISSIONING OF
  ELECTRICAL SYSTEMS
  ZDS Design/Consulting Services

- I. Underwriters Laboratory, Inc. (UL)
- J. Refer to Section 019113 for additional Reference Standards.

## 1.8 DOCUMENTATION

- A. Documentation shall be as required in Section 019113. In addition, Contractor shall also provide to the CxA the following per the procedures specified herein, in the Cx Plan, and in other Sections of the specifications:
  - Factory Test Reports: Contractor shall provide any factory testing documentation or certified test reports required by the specifications. These shall be provided prior to Acceptance Phase. Factory Test Reports shall be provided in PDF electronic format.
  - 2. Field Testing Agency Reports: Provide all documentation of work of independent testing agencies required by the specification. These shall be provided prior to Acceptance Phase. Field Testing Agency Reports shall be provided in PDF electronic format.

## 1.9 SEQUENCING AND SCHEDULING

A. Refer to Section 019113.

## 1.10 COORDINATION MANAGEMENT PROTOCOLS

A. Coordination responsibilities and management protocols relative to Cx are initially defined in Section 019113 and the Cx Plan, but shall be refined and documented in the Construction Phase Cx Kick-Off Meeting. Contractor shall have input into the protocols to be used and all Parties will commit to scheduling obligations. The CxA will record and distribute.

#### 1.11 CONTRACTOR RESPONSIBILITIES

A. Refer to Section 019113: Detailed Contractor responsibilities common to all Divisions are specified in Section 019113. The following are additional responsibilities or notable responsibilities specific to Division 26.

## B. Construction Phase

- 1. Provide skilled technicians qualified to perform the work required.
- 2. Provide factory-trained and authorized technicians where required by the Contract Documents.
- 3. Prepare and submit required draft Start-Up Documentation and submit along with the manufacturer's application, installation and start-up information.
- 4. Assist the CxA in preparation of the specific Functional Performance Test (FPT) procedures. Contractors, subcontractors and vendors shall review FPT procedures to ensure feasibility, safety and equipment protection and provide

- necessary written alarm limits to be used during the tests. Damage caused to equipment performed in accordance with the approved procedures will be the responsibility of the Contractor.
- 5. Thoroughly complete and inspect installation of systems and equipment as detailed throughout Contract Documents, as required by reference or industry standards, and as specifically indicated elsewhere in this Section.
- 6. Start-Up, Adjust, Test, and Turn-Over systems and equipment prior to functional performance testing by the CxA. Approved Start-Up Documentation shall be in accordance with Contract Documents, reference or industry standards, and specifically elsewhere in Part I of this Section.
- 7. Record Start-Up on approved Start-Up Documentation forms and certify that the systems and equipment have been started and or tested in accordance with the requirements specified above and in Section 019113. Each task or item shall be indicated with the Party performing the task or procedure.
- 8. Coordinate the work of the Electrical Testing Agency and the Cx requirements.

# C. Acceptance Phase

1. Assist CxA in functional performance testing as needed.

## D. Warranty Phase

- 1. Maintain record documentation of any configurations, set ups, parameters etc., that change throughout the period.
- 2. Provide representative for off season testing as required by CxA.
- 3. Respond to warranty issues as required by Division 1 and the General Conditions.

#### 1.12 EQUIPMENT SUPPLIER RESPONSIBILITIES

A. Refer to Section 019113.

## 1.13 CONTRACTOR NOTIFICATION AND SCHEDULING

A. Refer to Section 019113.

## 1.14 START-UP DOCUMENTATION

A. Refer to Section 019113.

## 1.15 FUNCTIONAL PERFORMANCE TESTING (FPT)

A. Contractor shall participate in the support of Functional Performance Testing as stipulated in Section 019114 and Appendix A in Section 019115.

## 1.16 FPT ACCEPTANCE CRITERIA

A. Acceptance criteria for tests are indicated in the specification Sections applicable to the systems being tested. Unless indicated otherwise, the criteria for acceptance will be that specified with the individual system, equipment, component, or device, which shall typically conform to NFPA 70B and International Electrical Testing Association (NETA) testing specifications NETA ATS-1991.

## 1.17 TRAINING

A. Contractors, subcontractor, vendors, and other applicable Parties shall prepare and conduct training sessions on the installed systems and equipment they are responsible for per the requirements of Section 019113 and the individual Specifications.

## 1.18 O&M DOCUMENTATION CONTENT - PREPARATION AND LOGISTICS

A. Refer to Section 019113 and the individual Specifications

## PART 2 - PRODUCTS

## 2.1 INSTRUMENTATION

- A. General: All testing equipment used by any Party shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. Unless otherwise noted, all equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.
- B. Special Tools: Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and turned over to the Owner upon project completion.

## 2.2 WEB-BASED COMMISSIONING PORTAL

A. All general and major subcontractors participating in the Cx process shall use the webbased Cx Portal ('Portal') to document the Cx procedures (where used on the Project). The Portal is a Web-based Internet hub used to electronically collaborate and coordinate activities and deliverables throughout the Cx process. The Portal is hosted by the CxA and shall be accessible to all Parties participating in the Cx program. The Portal provides a common location to store Start-Up Documentation, Functional Performance Tests and results, project documents and deliverables. It also serves as a collaborative email hub to facilitate, automate, and track communications between Parties relating to the Cx process.

B. Refer to Section 019113 and the individual Specifications for additional information and requirements for using the Portal.

#### PART 3 - EXECUTION

## 3.1 GENERIC START-UP DOCUMENTATION - GENERAL

A. Please refer to the Commissioning Plan for preliminary copies of the pre-functional check lists and start-up tests for the various systems. These check lists outline 'generic' or minimally acceptable Start-Up Procedures (delineated as Start-Up Checks and Start-Up Tests) and individual systems Training requirements for systems and equipment. These procedures are the direct responsibility of the Contractor as a basic element of validating that the installation is correct per normal quality control practices. These items shall provide a minimum or guideline for required Contractor development of Start-Up Procedures. Contractor shall synthesize these minimum requirements along with their own internal quality control practices, those of the manufacturer, and any applicable codes and standards to develop specific and itemized Start-Up Procedures specific to the equipment and systems installed on this project.

# 3.2 START-UP CHECKS COMMON TO ALL SYSTEMS

- A. The following Start-Up verifications and procedures shall be considered common to all systems:
  - 1. Checkout shall proceed from lower level devices to larger components to the entire system operation.
  - 2. Verify labeling is affixed per specification and visible.
  - 3. Verify prerequisite procedures are done.
  - 4. Inspect for damage and ensure none is present.
  - 5. Verify system is installed per the manufacturer's recommendations.
  - 6. Verify system has undergone Start-Up per the manufacturer's recommendations.
  - 7. Verify that access is provided for inspection, operation and repair.
  - 8. Verify that access is provided for eventual replacement of the equipment.
  - 9. Verify that record drawings, submittal data and O&M documentation accurately reflect the installed systems.
  - 10. Verify all gauges and test ports are provided as required by the contract documents and manufacturer's recommendations.
  - 11. Verify all recorded nameplate data is accurate.
  - 12. Verify that the installation ensures safe operation and maintenance.
  - 13. Verify specified replacement material/attic stock has been provided as required by the Contract Documents.
  - 14. Verify all rotating and moving parts are properly lubricated.
  - 15. Verify all monitoring and ensure all alarms are active and set per Owner's requirements.

END OF SECTION 260800

#### SECTION 260923 - LIGHTING CONTROL DEVICES

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section Includes:
  - 1. Indoor occupancy and vacancy sensors.
  - 2. Conductors and cables.

# 1.3 ACTION SUBMITTALS

- A. Product Data:
  - 1. For each type of product.
- B. Shop Drawings:
  - 1. Show installation details for the following:
    - Occupancy sensors.
    - b. Vacancy sensors.
  - 2. Interconnection diagrams showing field-installed wiring.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Field quality-control reports.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's warranties.

#### 1.5 WARRANTY

- A. Special Extended Warranty: Manufacturer and Installer warrant that installed lighting control devices perform in accordance with specified requirements and agree to repair or replace, including labor, materials, and equipment, devices that fail to perform as specified within extended warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of lighting control software.
    - b. Faulty operation of lighting control devices.
  - 2. Extended Warranty Period: Two 2 year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

#### 2.1 INDOOR OCCUPANCY AND VACANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acuity Brands
  - 2. Eaton
  - 3. Leviton Manufacturing Company
- B. General Requirements for Sensors:
  - 1. Ceiling-mounted, solid-state indoor occupancy and vacancy sensors.
  - 2. Dual technology.
  - 3. Integrated power pack.
  - 4. Hardwired connection to switch.
  - 5. Listed and labeled in accordance with NFPA 70, by a qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
  - 6. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    - c. Combination Sensor: Unless otherwise indicated, sensor must be programmed to turn lights on when coverage area is occupied and turn them off when unoccupied, or to turn off lights that have been manually turned on; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 7. Sensor Output: Sensor is powered from the power pack.
  - 8. Power: Line voltage.

- 9. Power Pack: Dry contacts rated for 20 A LED load at 120 and 277 V(ac), for 13 A tungsten at 120 V(ac), and for 1 hp at 120 V(ac). Sensor has 24 V(dc), 150 mA, Class 2 power source.
- 10. Mounting:
  - a. Sensor: Suitable for mounting in any position in a standard device box or outlet box.
  - b. Relay: Externally mounted through a 1/2 inch knockout in a standard electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 11. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- 12. Bypass Switch: Override the "on" function in case of sensor failure.
- 13. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is 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 minimum movement of any portion of a human body that presents a target of not less than 36 sq. inch, and detect a person of average size and weight moving not less than 12 inch in either a horizontal or a vertical manner at an approximate speed of 12 inch/s.
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96 inch high ceiling.
  - 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 2000 sq. ft. when mounted 42 inches above finished floor, above finished floor.

## 2.2 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "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 Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION OF SENSORS

- 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 systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's instructions.

#### 3.3 INSTALLATION OF WIRING

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch.
- B. Wiring within Enclosures: Separate power-limited and nonpower-limited conductors in accordance with conductor manufacturer's instructions.
- C. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, device, and outlet boxes; terminal cabinets; and equipment enclosures.

## 3.4 IDENTIFICATION

- A. Identify components and power and control wiring in accordance with Section 260553 "Identification for Electrical Systems.
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires 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. Field tests must be witnessed by Engineer and/or Owner's representative.
- B. Tests and Inspections:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Nonconforming Work:
  - 1. Lighting control devices will be considered defective if they do not pass tests and inspections.
  - 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.
- E. Manufacturer Services:
  - 1. Engage factory-authorized service representative to support field tests and inspections.

## 3.6 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to 2 visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

#### 3.7 MAINTENANCE

- A. Software and Firmware Service Agreement:
  - 1. Technical Support: Beginning at Substantial Completion, verify that software and firmware service agreement includes software support for two years.
  - 2. Upgrade Reports: Prepare written report after each update, documenting upgrades installed.

**END OF SECTION 260923** 

#### SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

#### PART 1 - GENERAL

## 1.1 QUALITY ASSURANCE

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.
- D. If an independent testing agency is required, see Section 014000 "Quality Requirements" for general testing and inspecting agency qualification requirements. If additional control is needed, retain one of first two paragraphs below to specify 29 CFR 1910.7 or other more specific criteria (e.g., NETA). 29 CFR 1910.7 defines a nationally recognized testing laboratory as it applies to testing and inspecting for safety, and lists, labels, or accepts equipment and materials that meet certain OSHA criteria.
- E. Source Limitations: Obtain each transformer type through one source from a single manufacturer.
- F. 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.
- G. Comply with IEEE C57.12.91, "Test Code for Dry-Type Distribution and Power Transformers."

## 1.2 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

#### 1.3 COORDINATION

A. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

B. Coordinate installation of wall-mounting and structure-hanging supports with actual transformer provided.

#### 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. Eaton Electrical Inc.; Cutler-Hammer Products.
  - 2. Federal Pacific Transformer Company; Division of Electro-Mechanical Corp.
  - 3. General Electric Company.
  - 4. Square D; Schneider Electric.

# 2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Cores: Grain-oriented, non-aging silicon steel.
- C. Coils: Continuous windings without splices except for taps.
  - 1. Internal Coil Connections: Brazed or pressure type.
  - 2. Coil Material: Aluminum.

# 2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NEMA ST 20, and list and label as complying with UL 1561.
- B. Cores: One leg per phase.
- C. Enclosure: Ventilated, NEMA 250, Type 2.
  - 1. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- D. Transformer Enclosure Finish: Comply with NEMA 250.
  - 1. Finish Color: Gray.
- E. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- F. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

- G. Energy Efficiency for Transformers Rated 15 kVA and Larger:
  - 1. Complying with NEMA TP 1, Class 1 efficiency levels.
  - 2. Tested according to NEMA TP 2.
- H. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for non-sinusoidal load current-handling capability to the degree defined by designated K-factor.
  - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
  - 2. Indicate value of K-factor on transformer nameplate.
  - 3. Unit shall meet requirements of NEMA TP 1 when tested according to NEMA TP 2 with a K-factor equal to one.
- I. Neutral: Rated 200 percent of full load current for K-factor rated transformers.
- J. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
  - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
  - 2. Include special terminal for grounding the shield.
  - 3. Shield Effectiveness:
    - a. Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.
    - b. Common-Mode Noise Attenuation: Minimum of minus 120 dBA at 0.5 to 1.5 kHz; minimum of minus 65 dBA at 1.5 to 100 kHz.
    - c. Normal-Mode Noise Attenuation: Minimum of minus 52 dBA at 1.5 to 10 kHz.
- K. Wall Brackets: Manufacturer's standard brackets.
- L. Fungus Proofing: Permanent fungicidal treatment for coil and core.
- M. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

#### 2.4 IDENTIFICATION DEVICES

A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Division 26 Section "Identification for Electrical Systems."

## 2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.91.
- B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

## PART 3 - EXECUTION

# 3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
- B. Construct concrete bases and anchor floor-mounting transformers according to manufacturer's written instructions.

# 3.3 CONNECTIONS

- A. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables".
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

#### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:

- 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
  - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
  - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- E. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

#### 3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

## 3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

**END OF SECTION 262200** 

#### SECTION 262726 - WIRING DEVICES

#### PART 1 - GENERAL

## 1.1 GENERAL

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

#### A. Section Includes:

- 1. Receptacles, receptacles with integral GFCI, and associated device plates.
- 2. Weather-resistant receptacles.
- 3. Snap switches and wall-box dimmers.

## 1.3 ADMINISTRATIVE REQUIREMENTS

## A. Coordination:

- 1. Receptacles for equipment furnished by "Others": Match plug configurations.
- 2. Cord and Plug Sets: Match equipment requirements.

## 1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of wiring device and associated wall plate from same source manufacturer.

## 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with the requirements in this Section.

## 2.3 GFCI RECEPTACLES

- A. General Description:
  - 1. Straight blade, feed or non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
    - a. Cooper; VGF20.
    - b. Hubbell; GFR5352L.
    - c. Pass & Seymour; 2095.
    - d. Leviton; 7590.

# 2.4 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Single Pole, 2-pole, 3-way and 4-way:
      - 1) Cooper
      - 2) Hubbell
      - 3) <u>Leviton</u>
      - 4) Pass & Seymour
- C. Key-Operated Switches, 120/277 V, 20 A:

- 1. <u>Products:</u> Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following
  - a. Cooper; AH1221L.
  - b. Hubbell; HBL1221L.
  - c. <u>Leviton; 1221-2L.</u>
  - d. Pass & Seymour; PS20AC1-L.
- 2. Description: Single pole, with factory-supplied key in lieu of switch handle.

#### 2.5 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel. NOTE: All wall plates provided in the Auditorium shall be black steel finish.
  - 3. Material for Unfinished Spaces: Galvanized steel.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

#### 2.6 FINISHES

## A. Device Color:

 Wiring Devices: As selected by Owner unless otherwise indicated or required by NFPA 70 or device listing. NOTE: All devices provided in the Auditorium shall be black in color.

#### PART 3 - EXECUTION

#### 3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

#### B. Conductors:

- 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
- 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
- 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
- 4. Existing Conductors:
  - a. Cut back and pigtail, or replace all damaged conductors.
  - b. Straighten conductors that remain and remove corrosion and foreign matter.

c. Pig-tailing existing conductors is permitted, provided the outlet box is large enough.

# C. Device Installation:

- 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
- 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
- 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
- 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
- 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
- 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
- 7. Tighten unused terminal screws on the device.
- 8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

# D. Receptacle Orientation:

- 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. 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, multi-gang wall plates.
- G. All cover plates shall be secured with vandal-resistant/tamper-proof screws.

## 3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

#### 3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
- B. Identify each receptacle with panel-board identification and circuit number.

## 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 108 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

**END OF SECTION 262726** 

#### SECTION 262816 - 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 and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Non-fusible switches.
  - Enclosures.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include wiring diagrams for power, signal, and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
    - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

## 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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

## 1.8 QUALITY ASSURANCE

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

# 1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year from date of Substantial Completion.

# PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- C. Comply with NFPA 70.

#### 2.2 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty:
  - 1. Single or Double throw.
  - 2. Three-pole.
  - 3. 240 or 600V AC as applicable
  - 4. 200 A and smaller.
  - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses.
  - 6. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.

#### B. Accessories:

- 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
- 4. Lugs: Mechanical/Compression type, suitable for number, size, and conductor material.
- 5. Service-Rated Switches: Labeled for use as service equipment.

# 2.3 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Three Pole, Single Throw, 240-V ac, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Accessories:

- 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
- 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
- 3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
- 4. Lugs: Mechanical]/Compression type, suitable for number, size, and conductor material.
- 5. Service-Rated Switches: Labeled for use as service equipment.

## 2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Type 3R).
- C. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1) or directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

## 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 of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

## 3.2 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.

#### 3.3 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

## 3.4 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

## 3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
        - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
    - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
    - i. Verify correct phase barrier installation.
    - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
  - 2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Measure contact resistance across each switchblade fuse-holder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."
- B. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.
  - 1. Test procedures used.
  - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

# 3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

END OF SECTION 262816

#### SECTION 265119 - LED INTERIOR LIGHTING

#### PART 1 - GENERAL

# 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 Mechanical, Electrical and Plumbing General requirements applies to and forms a part of all specifications. Articles of this section shall govern unless superseded by specific stipulations of that Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.

# 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior Lighting
- B. Related Requirements:
  - 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of luminaire.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

- 1. Arrange in order of luminaire designation.
- 2. Include data on features, accessories, and finishes.
- 3. Include information illustrated within the Luminaire Schedule.
- 4. Include physical description and dimensions of luminaires.
- 5. Include emergency lighting units, including batteries and chargers.
- 6. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
- 7. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type.
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Luminaires.
  - 2. Suspended ceiling components.
  - 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  - 4. Structural members to which equipment and or luminaires will be attached.
  - 5. Initial access modules for acoustical tile, including size and locations.
  - 6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Exit signs.
    - c. Bulkheads.
    - d. Air outlets and inlets.
    - e. Speakers.
    - f. Sprinklers.
    - g. Access panels.
    - h. Ceiling-mounted projectors.
    - i. Fire alarm devices (as they apply).
    - j. Lighting control devices.
  - 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.

- C. Product Certificates: For each type of luminaire.
- D. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Sample warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  - 1. Provide a list of all luminaires complete with description of accessories and respective lumen package.

## 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. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

## 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications:
  - 1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
  - 2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

# 1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

#### PART 2 - PRODUCTS

## 2.1 LUMINAIRE REQUIREMENTS

- A. <u>Manufacturers:</u>Manufacturers Subject to compliance with requirements, provide products from one of the following:
  - 1. Acquity Brands Lighting, Inc.
  - 2. Cooper Industries
  - 3. Philips Lighting
  - 4. Hubbell Lighting
- 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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. Lumen output.
    - b. Color temperature.
    - c. CCT and CRI.
    - d. Dimming gradation
    - e. Controls functions
- D. Recessed luminaires shall comply with NEMA LE 4.
- E. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

# 2.2 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: 41 to 104 deg F.
  - 1. Relative Humidity: Zero to 95 percent.
- B. Altitude: Sea level to 3,000 feet.

#### 2.3 MATERIALS

#### A. Metal Parts:

- 1. Free of burrs and sharp corners and edges.
- 2. Sheet metal components shall be steel unless otherwise indicated.
- 3. Form and support to prevent warping and sagging.

#### B. Steel:

- 1. ASTM A36/A36M for carbon structural steel.
- 2. ASTM A568/A568M for sheet steel.

#### C. Stainless Steel:

- 1. Manufacturer's standard grade.
- 2. Manufacturer's standard type, ASTM A240/240M.
- D. Galvanized Steel: ASTM A653/A653M.
- E. Aluminum: ASTM B209.

#### 2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

# 2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires for ceiling grid mounted luminaires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gauge, see detail .
- D. Wire for exposed ceiling suspended luminaires: 5/32-inch diameter aircraft cable supports.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

#### 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 roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 TEMPORARY LIGHTING

A. If approved by the Engineer, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

## 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

## C. Supports:

- 1. Sized and rated for luminaire weight.
- 2. Able to maintain luminaire position after cleaning and relamping.
- 3. Provide support for luminaire independent of ceiling system see details.
- 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

#### D. Flush-Mounted Luminaires:

- 1. Secured to outlet box.
- 2. Attached to building structural members above ceiling at four corners of the luminaire.
- 3. Trim ring flush with finished surface.

# E. Wall-Mounted Luminaires:

- See detail.
- 2. Do not attach luminaires directly to gypsum board.
- F. Suspended Luminaires:

- 1. Ceiling Mount: See luminaire support above.
- 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
- 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
- 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at two points, one at each end. Use wire support for required intermediate support(s).
- 5. Do not use ceiling grid as support for pendant luminaires. Connect support wires and rods to building structure.

# G. Ceiling-Grid-Mounted Luminaires:

- 1. Secure to any required outlet box.
- 2. Attached to building structural members above ceiling at four corners of the luminaire, see detail.
- 3. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, at each corner of the luminaire.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

## 3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

# 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Required Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

## 3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 18 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to four visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

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- 1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective.
- 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
- 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

# **DIVISION 31** EARTHWORK

#### SECTION 312000 - EARTH MOVING

#### PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.
- B. Section 011001 General Mechanical and Electrical Requirements applies to and forms a part of all Divisions. Articles of this section shall govern unless superseded by specific stipulations of other Divisions of the Specifications.
- C. General notes on all drawings apply to and form a part of the Specifications.
- D. The Contractor's attention is directed to the General and Special Conditions, General Conditions- Mechanical and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.
- E. The Contractor shall include all excavating, filling, grading, seeding, and related items required to complete the work as indicated within the drawings and specifications. All systems shall be reconnected, connected, adjusted. The work shall NOT be considered complete until the systems are operating in a satisfactory manner.

## 1.2 SUMMARY

#### A. Section Includes:

- 1. Excavating and filling for rough grading the Site.
- 2. Preparing subgrades for slabs-on-grade, walks, pavements, turf, and grasses.
- 3. Excavating and backfilling for structures.
- 4. Drainage course for concrete slabs-on-grade.
- 5. Subbase course for concrete walks and pavements.
- 6. Subbase course and base course for asphalt paving.
- 7. Subsurface drainage backfill for walls and trenches.
- 8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

## B. Related Requirements:

1. Section 013200 "Construction Progress Documentation" for recording preexcavation and earth-moving progress.

## 1.3 EXTENTS OF ROCK EXCAVATION

- A. Prices for rock excavation shall include removing rock from the excavation, to the extents listed below, and replacement with approved materials.
  - 1. 24 inches outside of concrete forms other than at footings.
  - 2. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - 3. 6 inches beneath bottom of concrete slabs-on-grade.
  - 4. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

#### 1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices and changes in the Work.
  - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
  - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.

- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

#### 1.5 PREINSTALLATION MEETINGS

- A. Submit a list of proposed mandatory representatives for approval, prior to Preinstallation Conference.
- B. Preinstallation Conference: Conduct pre-excavation conference at Project site.
  - 1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
    - a. Personnel and equipment needed to make progress and avoid delays.
    - b. Discuss existing conditions based on the pre-excavation photos and/or video.
    - c. Discuss material storage areas.
    - d. Discuss the potential for encountering underground appurtenances not otherwise found during the site survey.
    - e. Coordination of Work with utility locator service and the Owner.
    - f. Coordination of Work and equipment movement with the locations of tree and plant protection zones.
    - g. Extent of trenching by hand or with air spade.
    - h. Propose methods for bracing trench walls and indicate proof the methods proposed shall comply with:
    - i. Local Regulations.
    - j. "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc.
    - k. Current OSAH standards.
    - I. Field quality control.
    - m. Determine location of benchmarks for documenting completed work and appurtenances encountered during the project.
    - n. Documenting installed piping and documenting existing utilities encountered during excavating.

#### 1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

- 1. Geotextiles.
- 2. Controlled low-strength material, including design mixture.
- 3. Warning tapes.
- B. Samples for Verification: For the following products, in sizes indicated below:
  - 1. Geotextile: 12 by 12 inches.
  - 2. Warning Tape: 12 inches long; of each color.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
  - 1. Classification according to ASTM D2487.
  - 2. Laboratory compaction curve according to ASTM D698.
- C. Pre-excavation Photographs or Video: Show existing conditions within limits of construction and of areas adjoining construction. Include within the existing documentation finish surfaces that might be misconstrued as damaged caused by earthmoving operations. Submit documentation prior to earth moving begins.

## 1.8 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

#### 1.9 FIELD CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or use facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways as required by Owner or authorities having jurisdiction.
  - 3. Do not obstruct paths of egress without providing an approved alternate path.
- B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract. Do not proceed with work on adjoining property until directed by Engineer.
- C. Do not commence earth-moving operations until preinstallation conference has be held and all methods and procedures have been approved.

- D. Do not commence earth-moving operations until temporary site fencing and erosion and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" and are in place.
- E. Do not commence earth-moving operations until plant protection zones and plant protection measures are in place.
- F. The following practices are prohibited within protection zones:
  - 1. Storage of construction materials, debris, or excavated material.
  - 2. Parking vehicles or equipment.
  - Foot traffic.
  - 4. Erection of sheds or structures.
  - 5. Impoundment of water.
  - 6. Excavation or other digging unless otherwise indicated.
  - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

## PART 2 - PRODUCTS

#### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90

- percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inchsieve and zero to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C33/C33M; fine aggregate.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

#### 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Survivability: As follows:
    - a. Grab Tensile Strength: 157 lbf; ASTM D4632.
    - b. Sewn Seam Strength: 142 lbf; ASTM D4632.
    - c. Tear Strength: 56 lbf; ASTM D4533.
    - d. Puncture Strength: 56 lbf; ASTM D4833.
  - 3. Apparent Opening Size: No. 40 sieve, maximum; ASTM D4751.
  - 4. Permittivity: 0.2 per second, minimum; ASTM D4491.
  - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Survivability: As follows:
    - a. Grab Tensile Strength: 247 lbf; ASTM D4632.
    - b. Sewn Seam Strength: 222 lbf; ASTM D4632.
    - c. Tear Strength: 90 lbf; ASTM D4533.
    - d. Puncture Strength: 90 lbf; ASTM D4833.
  - 3. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.
  - 4. Permittivity: 0.02 per second, minimum; ASTM D4491.
  - 5. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

## 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Self-compacting, low-density, flowable concrete material produced from the following:
  - 1. Portland Cement: ASTM C150/C150M, Type I.
  - 2. Fly Ash: ASTM C618, Class C or F.
  - 3. Normal-Weight Aggregate: ASTM C33/C33M, 3/8-inch nominal maximum aggregate size.
  - 4. Foaming Agent: ASTM C869/C869M.
  - 5. Water: ASTM C94/C94M.
  - 6. Air-Entraining Admixture: ASTM C260/C260M.
- B. Produce low-density, controlled low-strength material with the following physical properties:
  - 1. As-Cast Unit Weight: 36 to 42 lb/cu. ft. at point of placement, when tested according to ASTM C138/C138M.
  - 2. Compressive Strength: 140 psi, when tested according to ASTM C495/C495M.
- C. Produce conventional-weight, controlled low-strength material with 140-psi compressive strength when tested according to ASTM C495/C495M.

## 2.4 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
  - 1. Red: Electric.
  - 2. Yellow: Gas, oil, steam, and dangerous materials.
  - 3. Orange: Telephone and other communications.
  - 4. Blue: Water systems.
  - 5. Green: Sewer systems.

## PART 3 - EXECUTION

#### 3.1 PREPARATION

A. The Contractor shall provide and maintain barricades and temporary bridges around excavations as required for safety. Temporary bridges shall be provided where excavations cross paved areas and walks. The Contractor shall maintain these bridges in a safe and passable condition for all traffic until excavations are backfilled. Refer to OSHA Standards for such installations and comply with same in all details.

- B. The Contractor shall provide and maintain egress patterns impacted by the excavation. The egress pattern shall be maintained as a safe and passable condition satisfactory to the Authority Having Jurisdiction.
- C. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.
- D. Protect and maintain erosion and sedimentation controls during earth-moving operations.
- E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

#### 3.2 DEWATERING

- A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
- B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- C. Keep trenches free from water while construction therein is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper jointing of pipe. Any water pumping from this Contractor's trenches which is required during construction, shall be included in this Contract.
- D. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas.
  - 2. Do not allow water to accumulate in excavations.
  - 3. Do not use excavated trenches as temporary drainage ditches.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

## 3.3 EXPLOSIVES

A. Explosives: THE USE OF EXPLOSIVES IS NOT PERMITTED.

## 3.4 EXCAVATION, GENERAL

A. Pay attention to existing utilities and piping to avoid damage. The locations of existing piping which are indicated on the plans were taken (unconfirmed) from drawings prepared from previous construction projects and the locations are approximate only.

Also, certain water, gas, electric, storm and sanitary sewer utilities and other underground appurtenances, active or abandoned, may not appear on the drawings. It shall be the Mechanical Contractor's responsibility to ascertain the location of all piping and excavate with caution in their area. All said utilities shall be documented and illustrated within the point file and Contractor generated drawings.

- B. Machine excavation shall not be allowed within ten feet of existing electric utility lines. Use only hand tools.
- C. Machine excavation shall be held an adequate distance from foundations and footings to ensure no damage to the same. Contractor shall accept full responsibility for any damage caused during the Contractor's work. The Contractor shall correct damages to structural members, footings, etc. caused by the execution of the Contract.
- D. The removal of rock shall be accomplished by use of hand and/or power tools only. Blasting is not permitted. Any damage to existing structures, exterior services, or rock intended for bearing, during excavation, shall be corrected at the Contractor's expense.
- E. In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, utility piping, large trees to remain, etc. The Contractors shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage or any other damage incurred during excavation shall be borne by the responsible Contractor.
- F. The Contractor shall accept the site as he finds it and remove all trash, rubbish, and material from the site prior to starting excavation of his work.
- G. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. Unsatisfactory soil shall not be used for backfilling. Remove unsatisfactory material from the site. Backfill with satisfactory materials.
  - 2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
    - a. 24 inches outside of concrete forms other than at footings.
    - b. 12 inches outside of concrete forms at footings.
    - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
    - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    - e. 6 inches beneath bottom of concrete slabs-on-grade.
    - f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.
- H. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Engineer. The Contract Sum will be adjusted for rock excavation according

to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.

- Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation. Ripping of material not classified as rock excavation shall be considered earth excavation.
- 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
  - a. 24 inches outside of concrete forms other than at footings.
  - b. 12 inches outside of concrete forms at footings.
  - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - d. 6 inches beneath bottom of concrete slabs-on-grade.
  - e. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

## 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
  - 1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

### 3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

## 3.7 EXCAVATION FOR UTILITY TRENCHES

- A. When installing any type of pipe below building footing, parallel or perpendicular to the footing, the area underneath the footing and in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45-degree angle projecting down from the bottom edge of footers on all sides of the footing. Piping within flowable fill shall be isolated from the fill by a layer of heavy duty felt paper. Piping installed in trenches backfilled with flowable fill shall be anchored to the soil below prior to backfilling.
- B. When installing any type of piping below a footer or in the zone of influence the piping shall be backfilled with cementitious flowable fill. The zone of influence is the area under the footer within a 45-degree angle projecting down from the bottom edge of the footer on all sides of the footer. Additionally, manholes, vaults, and other underground structures shall be held away from building walls far enough to be outside of the zone of influence.
- C. Use surveyor's level to establish elevations and grades.
- D. Excavate trenches to indicated gradients, lines, depths, and elevations. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- E. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 1'-0" higher than top of pipe or conduit unless otherwise indicated.
  - 1. Clearance: 1'-0" minimum clear distance on each side of pipe or conduit or as indicated.
  - 2. Trenches shall be excavated to such that all pipe placement, piping connections, welding, testing, etc. can be performed adequately.
- F. Rules and regulations established by the respective utilities shall be observed in executing all work. Active utilities discovered during excavation shall be protected or relocated in accordance with written instructions from the Engineer. The location of the utilities shall be documented, within the point files and drawings. Inactive and abandoned utilities encountered in trenching operations shall be removed and abandoned with ends plugged or capped in accord with current codes and safe practice. The abandoned utilities shall be documented within the point files and drawings. If underground utilities not illustrated on the drawings are encountered, contact the Engineer.
- G. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. Excavate trenches a minimum of 6 inches deeper than the required elevation for bedding course.
  - 2. Shape bottom of trench to support bottom 90 degrees of pipe, at the required elevation, for pipe circumference.

- H. Perform final grading of trench bottoms by hand tools; carry machine excavation only to such depth that soil bearing for pipes and raceways will not be disturbed. Grade the bottom of trenches evenly to ensure uniform bearing for all piping and raceways. Cut bell holes as necessary for joints and joint making. Except as hereinafter specified, bottom of trenches for bell and spigot pipe, flanged pipe, etc. shall be shaped to the lower quadrant of pipe with additional excavation for bell or flange. Piping installed where it rests on bell, or flange and/or is supported with blocks or wedges will not be accepted.
- I. Trenches in Tree- and Plant-Protection Zones:
  - Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots
  - 2. Do not cut main lateral roots or taproots; cut only very small roots that interfere with installation of utilities.
  - 3. If the existing root systems has engulfed the existing piping to be removed, the contractor shall abandon the piping in place. The abandoned piping shall be filled with concrete and capped on both ends.
  - 4. The alternate route, for the new piping, shall be approved by the Owner and the Engineer.

## 3.8 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work and the discretion of the Engineer.
- C. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

## 3.9 UNAUTHORIZED EXCAVATION

- A. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense. Carefully maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.
- B. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

C. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

#### 3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
  - 2. Stockpile areas of soil materials shall be established during the Preconference Meeting.

#### 3.11 BACKFILL

- A. Provide and place any additional fill material from off the site as may be required for backfill. Fill obtained from offsite shall be of kind and quality as specified for backfill and the source approved by the Engineer and shall be brought to the site by the Contractor requiring the fill.
- B. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring, bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- C. All materials used for back-fill around structures shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, large rocks, wood, and other extraneous or organic material.
- D. Place backfill on subgrades free of mud, frost, snow, or ice.

## 3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

- C. Trenches under Footings: Backfill trenches excavated under footings and within 1'-6" of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Trenches under Roadways: Provide 4-inch-thick, concrete-base slab support under roadway for piping or conduit less than 30 inches below surface of roadways.
- E. Backfill voids with satisfactory soil while removing shoring and bracing.

## F. Initial Backfill:

- 1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 1'-0" over the pipe or conduit. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- 2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 1'-0" inches over the pipe or conduit. Coordinate backfilling with utilities testing.
- G. Wherever, in the opinion of the Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting piping, special support shall be provided as directed by the Engineer.

#### H. Final Backfill:

- 1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
- 2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- I. Warning Tape: Install warning tape directly above utilities, 1'-0" below finished grade, except 6 inches below subgrade under pavements and slabs.

### 3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under structures slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

- D. Backfill beneath areas to be seeded or sodded within six (6) inches of finished grade. The remaining six (6) inches shall be backfilled with clean topsoil.
- E. Backfill beneath paved areas, walks, etc. shall be brought to proper grade to receive the sub-base and paving. No paving shall be placed on uncompacted fill or unstable soil.
- F. Backfill for underground vaults shall be in accord with the manufacturer's recommendations. If in doubt, contact the Engineers.

## 3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

#### 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated in the following two paragraphs.
  - 1. At a minimum, fill in grass areas shall be compacted to 90% Standard Proctor Density, ASTM D- 698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content.
  - 2. At a minimum, fill in concrete or asphalt area shall compact to 98% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content.
- B. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- C. In making the fills and terraces around the structures, the fill shall be placed in layers not exceeding 8 inches in depth and shall be kept smooth as the work progresses. Each layer of the fill shall be compacted. Sections of the fill immediately adjacent to buildings or structures shall be thoroughly compacted by means of mechanical tamping or hand tamping as may be required by the conditions encountered. All fills shall be placed to load structure symmetrically.
- D. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

- E. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- F. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 1'-0" of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

#### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Rough grading shall be held below finished grade and then the topsoil which has been stockpiled shall be evenly spread over the surface. The grading shall be brought to the levels as specified. Final dressing shall be accomplished by hand work or machine work, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than one inch in diameter. Excavated rock (1" and smaller) may be placed in the fills, but is shall be thoroughly covered. Rock placed in fills shall not be closer than 24 inches from finished grade.
- C. All manholes, vaults, and similar underground structures shall have the top elevation set flush with finished grade unless specifically noted otherwise.
- D. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
  - 1. Turf or Unpaved Areas: Plus, or minus 1 inch.
  - 2. Walks: Plus, or minus 1 inch.
  - 3. Pavements: Plus, or minus 1/2 inch.

#### 3.17 SUBSURFACE DRAINAGE

A. Subsurface Drain:

- 1. Place subsurface drainage geotextile around perimeter of subdrainage trench.
- 2. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe.
- 3. Encase subdrainage pipe in a minimum of 1'-0" of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
- 4. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.
- B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 1'-0" of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
  - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.
  - 2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

## 3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
  - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place base course material over subbase course under hot-mix asphalt pavement.
  - Shape subbase course and base course to required crown elevations and crossslope grades.
  - 4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
  - 5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698.
- C. Replace Existing Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D698.

#### 3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
  - 1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
  - 2. Place drainage course 6 inches or less in compacted thickness in a single layer.
  - 3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  - 4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

## 3.20 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
  - 1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
  - 2. Determine that fill material classification and maximum lift thickness comply with requirements.
  - 3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.
- B. Testing Agency: Engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.
- E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
  - 2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.

- 3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.
- F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify, and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.
- G. Maintenance Settling: Where settling is measurable or observable at excavated areas during Project Warranty Period, remove surface (pavement, concrete or any other surface or finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration.

#### 3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

#### 3.22 SODDING AND SEEDING

A. The Contractor shall lay new sod over his excavation work for existing grassy areas. The new seed or sod shall match the existing grass species. Level, with adjacent surface, compact and water in accordance with sound sodding practice. Hydroseeding may be used when approved by the Engineer instead of new sod.

## 3.23 RESTORATION OF NEW OR EXISTING LANDSCAING, PAVING, SURFACES, ETC.:

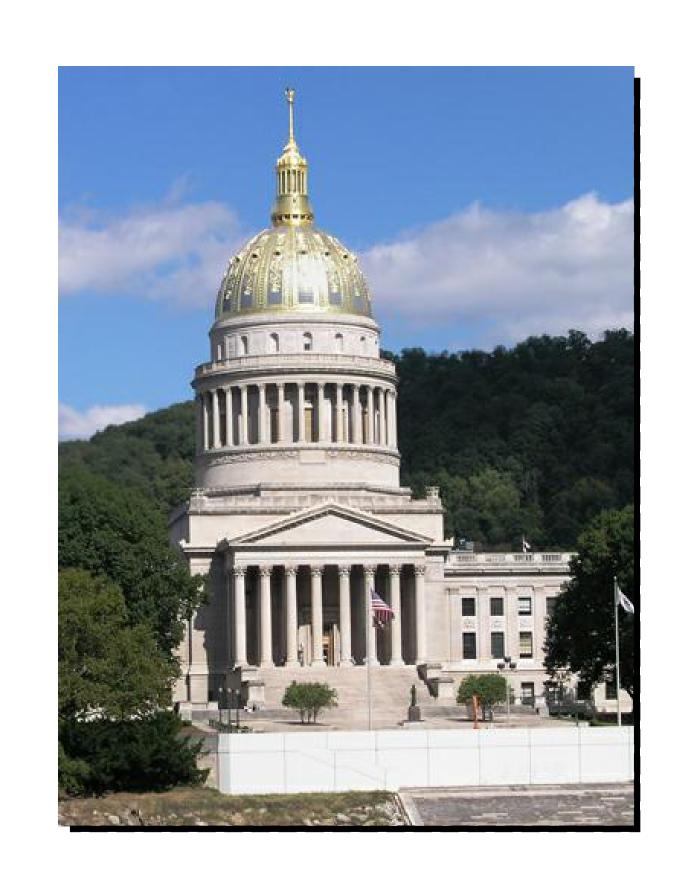
A. The Contractor shall at their expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, landscaping, existing or new building surfaces and appurtenances, and any other items damaged or removed by their operations. Replacement and repairs shall be in accordance with good construction practice; by qualified tradesman and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Owner and Engineer.

## 3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Unsuitable material and surplus excavated material not required for backfill shall be removed from the site. The location of dump and length of haul shall be the affected Contractor's responsibility.
- B. Unless otherwise directed by the Engineer during construction, excess topsoil, and subsoil suitable for fill shall be disposed of by the Contractor off site at no additional cost to the Owner.
- C. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.
- D. Disposal of Excess Non-organic Soil and Rock: Any excess excavated waste material shall become the property of the Contractor and shall be disposed of by the Contractor off site at no additional cost to the Owner.
- E. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.
  - 1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

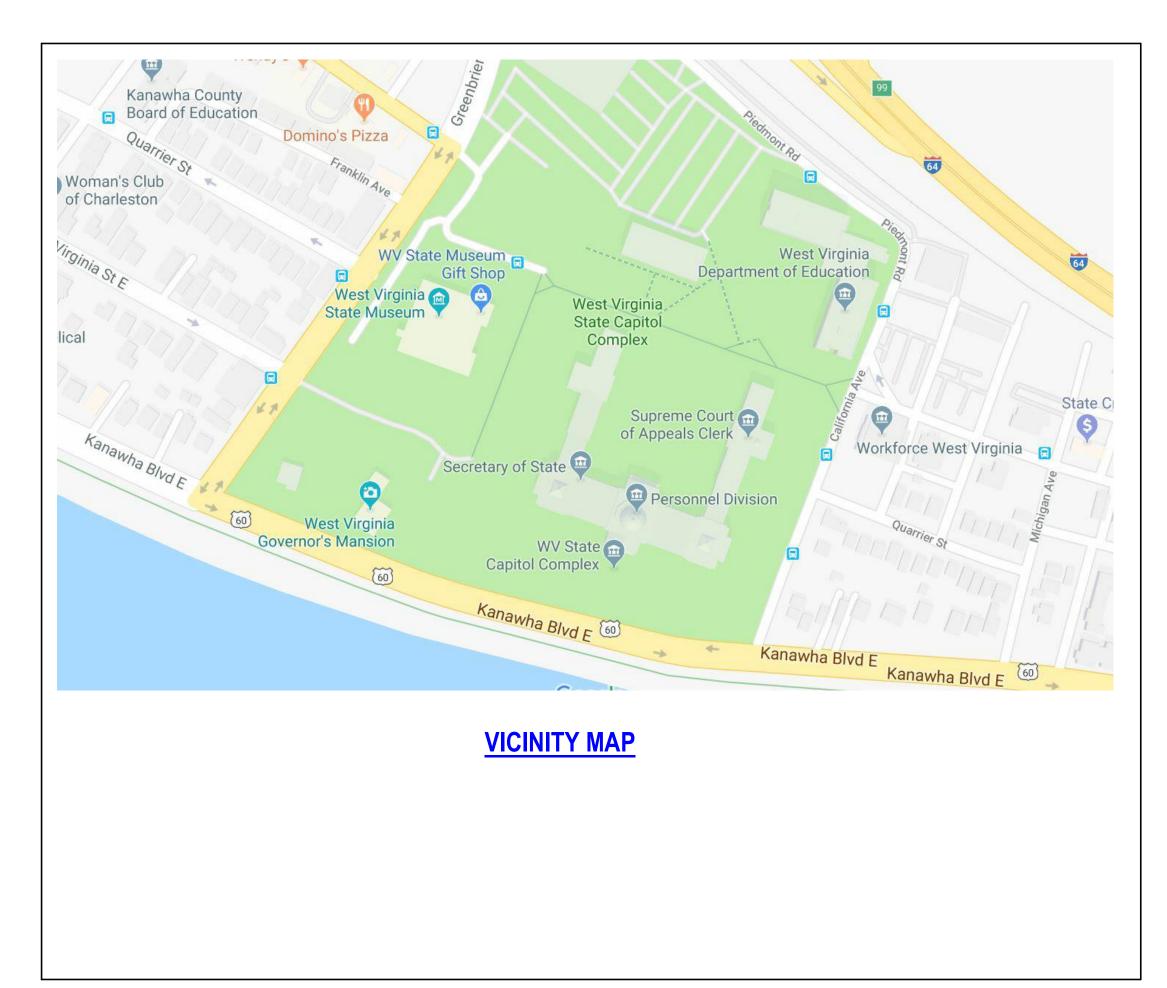
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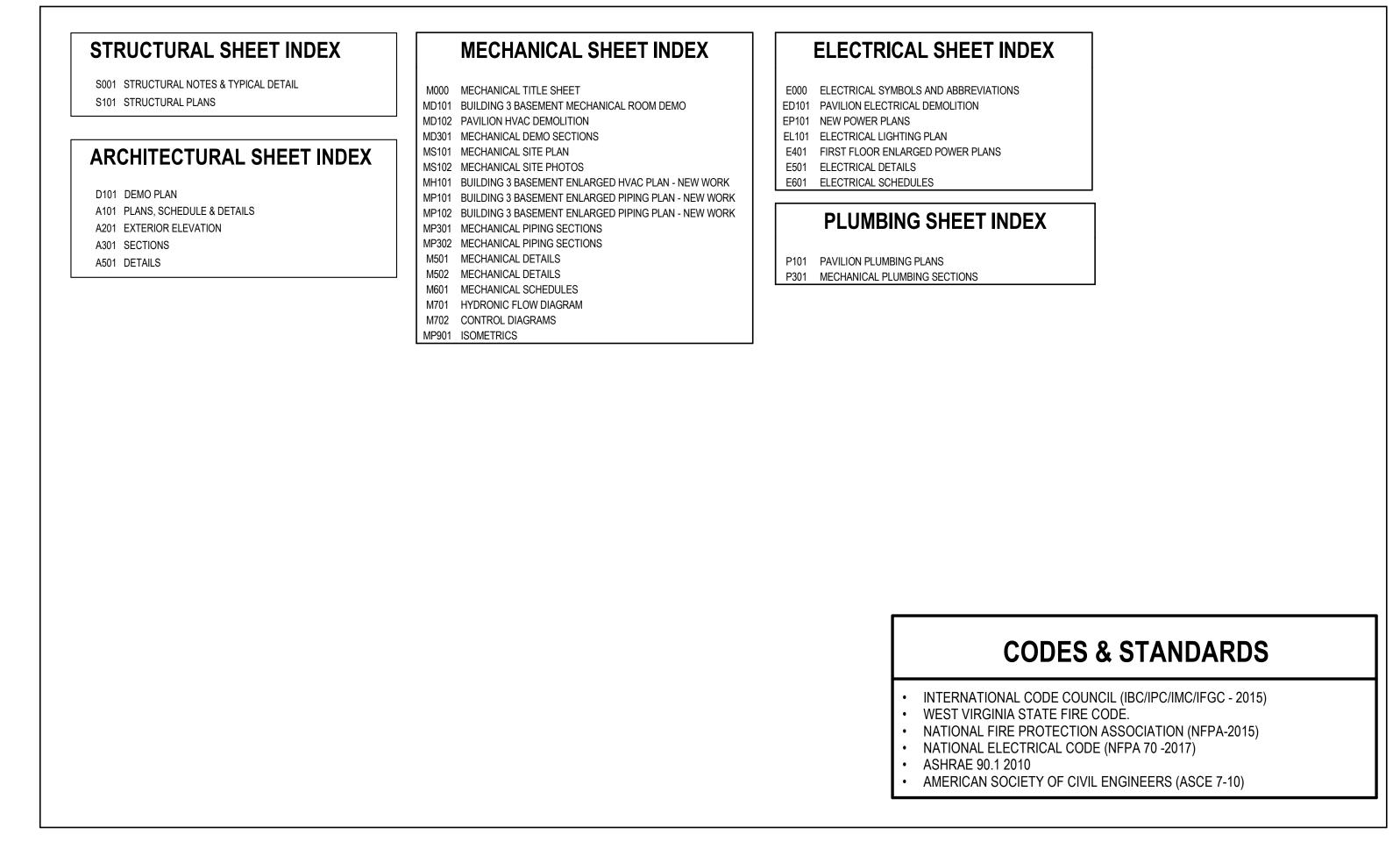
# West Virginia Department of Administration General Services Division Building #3 Hydronic Boiler System Upgrades

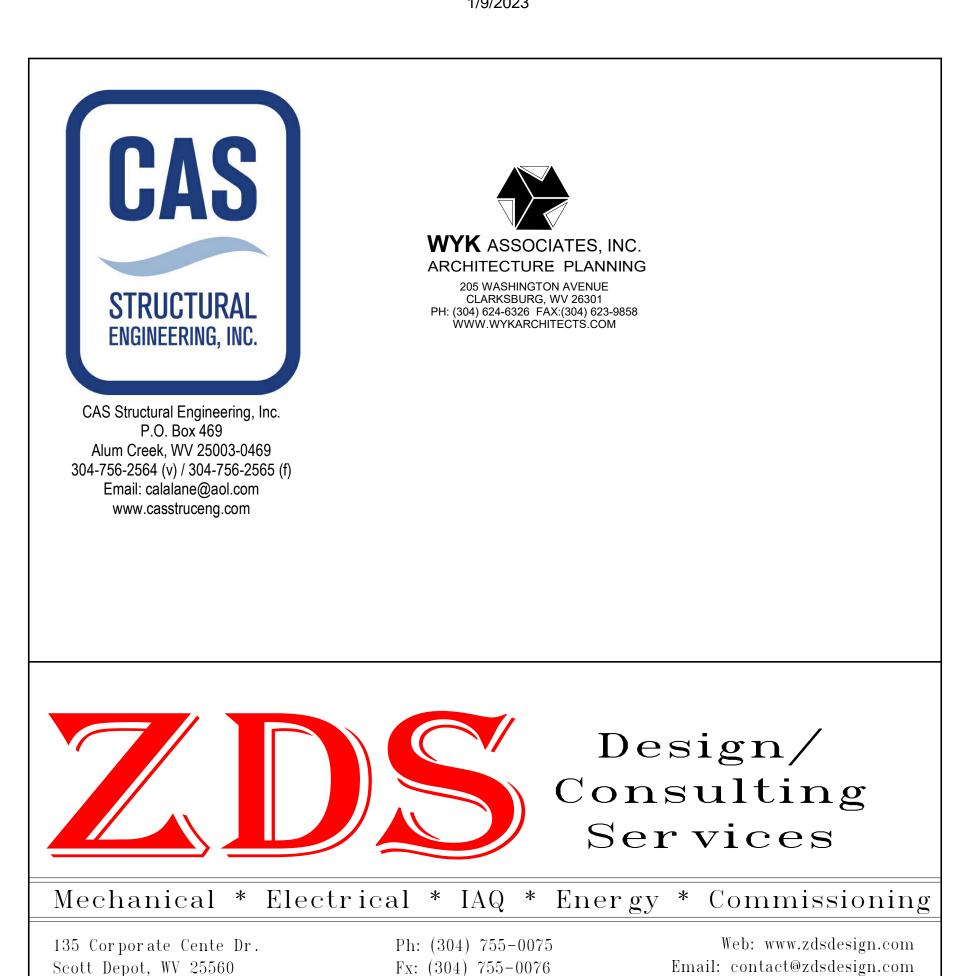


1900 Kanawha Boulevard East, Charleston, WV 25305 ZDS Project Number: GSD-221-C 1/09/2023









# SPECIAL INSPECTIONS

1. IT IS THE RESPONSIBILTY OF THE CONTRACTOR TO COORDINATE AND SCHEDULE THE SPECIAL INSPECTOR'S INSPECTIONS AND TESTING FOR THE WORK NOTED BELOW. THE FOLLOWING INFORMATION IS PROVIDED FOR THE CONTRACTOR'S INFORMATION AND COORDINATION PURPOSES.

2. SPECIAL INSPECTIONS SHALL BE PERFORMED FOR THE FOLLOWING WORK AS REQUIRED IN THE 2018 INTERNATIONAL BUILDING CODE: 2.1 STEEL CONSTUCTION IN ACCORDANCE WITH SECTION 1705.2

2.2 CONCRETE CONSTRUCTION IN ACCORDANCE WITH SECTION 1705.3 2.3 MASONRY CONSTRUCTION IN ACCORDANCE WITH SECTION 1705.4

THE ARCHITECT, AND THE STRUCTURAL ENGINEER.

2.4 SOILS CONSTRUCTION IN ACCORDANCE WITH SECTION 1705.6 3. THE TYPE AND EXTENT OF EACH TEST AND INSPECTION REQUIRED FOR EACH TYPE OF WORK SHALL BE AS INDICATED IN THE BUILDING CODE AND THE REFERENCES INCORPORATED THEREIN.

4. SPECIAL INSPECTION SERVICES SHALL BE CONTRACTED AND PAID FOR BY THE CONTRACTOR. 5. WORK REQUIRING SPECIAL INSPECTION SHALL BE INSPECTED BY THE SPECIAL INSPECTOR FOR THE CONFORMANCE WITH THE APPROVED DRAWINGS AND SPECIFICATIONS. INSPECTION REPORTS INDICATING THE RESULTS OF SPECIAL INSPECTIONS SHALL BE PROMPTLY SUBMITTED TO THE CONTRACTOR, THE ARCHITECT, AND THE STRUCTURAL ENGINEER. 6. ALL SPECIAL INSPECTIONS INDICATING NON-CONFORMING WORK SHALL BE REPORTED IMMEDIATELY TO THE CONTRACTOR, THE ARCHITECT AND THE STRUCTURAL ENGINEER. IMPENDING CONSTRUCTION WORK THAT WOULD IMPEDE ECONOMICAL CORRECTION OF NON-CONFORMING WORK SHALL NOT PROCEED WITHOUT WRITTEN APPROVAL. 7. A FINAL REPORT DOCUMENTING COMPLETION OF ALL REQUIRED SPECIAL INSPECTIONS AND CORRECTION OF ANY NON-CONFORMING WORK NOTED IN THE INSPECTIONS SHALL BE SUBMITTED BY THE SPECIAL INSPECTOR AT THE COMPLETION OF THE PROJECT. FINAL REPORT SHALL IDENTIFY ALL NON-CONFORMING WORK AND DISCUSS REMEDIATION THAT OCCURRED. 8. THE SPECIAL INSPECTION AGENCY SHALL NOT BE ENGAGED BY THE CONTRACTOR FOR OTHER TESTING OR INSPECTION SERVICES ON THIS

9. SPECIAL INSPECTION SHALL BE PERFOMED BY A QUALIFIED INSPECTION AND TESTING AGENCY APPROVED BY THE BUILDING OFFICAL,

# **CAST-IN-PLACE CONCRETE**

1. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING CODES

"BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, ACI 318-14", AMERICAN CONCRETE INSTITUTE

"ACI MANUAL OF CONCRETE PRACTICE - PARTS 1 THROUGH 5", LATEST EDITION "MANUAL OF STANDARD PRACTICE", CONCRETE REINFORCING STEEL INSTITUTE

CEMENT ASTM C150: TYPE I OR II AGGREGATES ASTM C33 NORMAL WEIGHT DEFORMED REINFORCING BARS ASTM A615, GRADE 60 WELDED WIRE FABRIC ASTM A185 AIR-ENTRAINING ADMIXTURE: ASTM C260

ACI 318-14 TABLE 19.3.1.1 - EXPOSURE CATEGORIES AND CLASSES

ACI 310-14 TABLE 19.3.1.1 - EXPOSORE CATEGORIES AND CLASSES			
CATEGORY	SEVERITY	CLASS	CONDITION
	NOT APPLICABLE	F0	CONCRETE NOT EXPOSED TO FREEZING - AND-THAWING CYCLES
F FREEZING	MODERATE	F1	CONCRETE EXPOSED TO FREEZING -AND- THAWING CYCLES AND OCCASIONAL EXPOSURE TO MOISTURE
AND THAWING	SEVERE	F2	CONCRETE EXPOSED TO FREEZING -AND- THAWING CYCLES AND IN CONTINUOUS CONTACT WITH MOISTURE
	VERY SEVERE	F3	CONCRETE EXPOSED TO FREEZING -AND- THAWING AND IN CONTINUOUS CONTACT WITH MOISTURE AND EXPOSED TO DEICING CHEMICALS

ACI 318-14 TABLE 19.3.2.1 - REQUIREMENTS FOR CONCRETE BY EXPOSURE CLASS

EXPOSURE CLASS	MAX. W/CM	MIN. f' <sub>c,</sub> PSI	ADDITIONAL MINIMUM REQUIREME	ENTS
			AIR CONTENT	LIMITS ON CEMENTI- TIOUS MATERIALS
F0	N/A	2500	N/A	N/A
F1	O.45	4500	TABLE 19.3.3.1	N/A
F2	O.45	4500	TABLE 19.3.3.1	N/A
F3	O.45	5000	TABLE 19.3.3.1	TABLE 26.4.2.2 (b)

ACI 318-14 TABLE 19.3.3.1- TOTAL AIR CONTENT FOR CONCRETE

EXPOSED TO CYCLES OF FREEZING AND THAWING			
	AIR CONTENT, PERCENT		
NOMINAL MAXIMUM AGGREGATE SIZE, IN.*	EXPOSURE CLASS F1	EXPOSURE CLASSES F2 AND F3	
3/8	6	7.5	
1/2	5.5	7	
3/4	5	6	
1	4.5	6	
1-1/2	4.5	5.5	
2 <sup>l</sup>	4	5	
31	3.5	4.5	
*SEE ASTM C33 FOR TOLERANCE ON OVERSIZE FOR VARIOUS NOMINAL MAXIMUM SIZE DESIGNATIONS.  AIR CONTENTS APPLY TO TOTAL MIXTURE. WHEN TESTING CONCRETES, HOWEVER, AGGREGATE PARTICLES LARGER THAN 1-1/2 IN. ARE REMOVED BY SIEVING AND AIR CONTENT IS MEASURED ON THE SIEVED FRACTION (TOLERANCE ON AIR CONTENT AS DELIVERED APPLIES TO THIS VALUE). AIR CONTENT OF TOTAL MIXTURE IS COMPUTED FROM VALUE			

MEASURED ON THE SIEVED FRACTION PASSING THE 1-1/2 IN.

SIEVE IN ACCORDANCE WITH ASTM C231.

ACI 318-14 TABLE 26.4.2.2 (b)- REQUIREMENTS FOR CONCRETE SUBJECT

CEMENTITIOUS MATERIALS	MAXIMUM PERCENT OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT*
FLY ASH OR OTHER POZZOLANS CONFORMING TO ASTM C618	25
SLAG CONFORMING TO ASTM C989	50
SILICA FUME CONFORMING TO ASTM C1240	10
TOTAL OF FLY ASH OR OTHER POZZOLANS, SLAG AND SILICA FUME	50
TOTAL OF FLY ASH OR OTHER POZZOLANS AND SILICA FUME	35
*THE TOTAL CEMENTITIOUS MATERIAL A C150, C595, C845, AND C1157 CEMENT. THE MAXIMUM PERCENTAGES ABOVE SI	

(a) FLY ASH OR OTHER POZZOLANS IN TYPE IP, BLENDED CEMENT ASTM C595, OR ASTM C1157. (b) SLAG USED IN THE MANUFACTURE OF AN IS BLENDED CEMENT, ASTM C595, OR ASTM C1157, (c) SILICA FUME, ASTM C1240, PRESENT IN A BLENDED CEMENT. FLY ASH OR OTHER POZZOLANS AND SILICA FUME SHALL CONSTITUTE NO MORE THAN 25 AND 10 PERCENT, RESPECTIVELY, OF THE TOTAL WEIGHT OF THE CEMENTITIOUS MATERIALS.

2. SLABS-ON-GRADE SHALL BE PLACED ON A VAPOR BARRIER OVER 4" MINIMUM OF WELL GRADED CRUSHED

3. IN SLABS-ON-GRADE, LAP WELDED WIRE FABRIC TWO FULL MESH PANELS AND WIRE TOGETHER.

4. CHAMFER ALL EXPOSED CONCRETE CORNERS UNLESS SHOWN ON THE ARCHITECTURAL DRAWINGS.

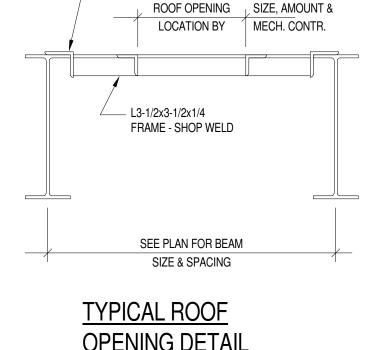
5. ALL FORM WORK, SHORING AND RESHORING SHALL BE DESIGNED BY THE CONTRACTOR'S ENGINEER REGISTERED IN THE PROJECT'S JURISDICTION.

BETWEEN SLABS AND INSERTS SUCH AS PIPES. AROUND STEEL COLUMNS AT SPREAD FOOTINGS.

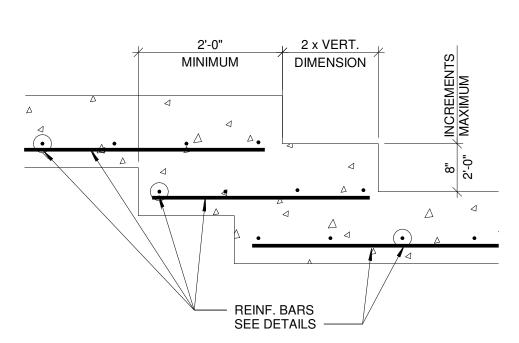
7. PROVIDE CONTRACTION JOINTS IN CONTINUOUS FLOOR SLABS ON GROUND IN A SQUARE PATTERN LOCATED AT NOT MORE THAN 10' O.C. IN BOTH DIRECTIONS, U.N.O.

# STONE OVER COMPACTED SUBGRADE.

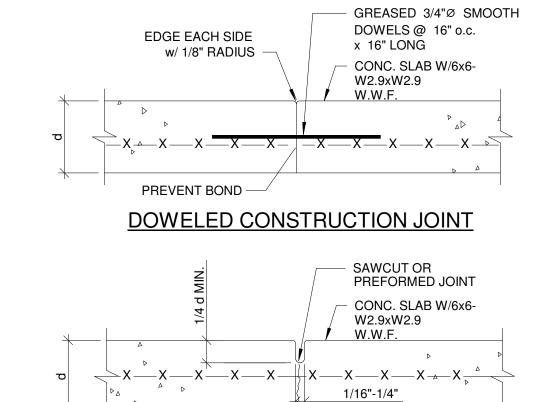
6. PROVIDE ISOLATION JOINTS IN SLABS AS FOLLOWS; BETWEEN SLABS-ON-GRADE AND FOUNDATION WALLS



L4x4x3/8 SEAT x 6" LONG, EACH END



TYPICAL STEPPED FOOTING DETAIL



SAWED OR PREFORMED CONTRACTION JOINT

TYPICAL SLAB JOINT DETAILS

# **MASONRY**

1. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING CODES AND STANDARDS:

LOAD BEARING CONCRETE

"BUILDING CODE REQUIREMENTS AND SPECIFICATION FOR MASONRY STRUCTURES", (ACI 530-13/ASCE 5-13/TMS 402-13) AND "SPECIFICATION FOR MASONRY STRUCTURES", (ACI 530. 1-13/ASCE 6-13/TMS 602-13).

ASTM C90, TYPE I, GRADE N (MIN. COMPRESSIVE

MASONRY UNITS	STRENGTH ON NET AREA = 1900 PSI) NORMAL WEIGHT
NON-LOAD BEARING CONCRETE MASONRY UNITS	ASTM C129, TYPE II
MORTAR	ASTM C270, TYPE S ABOVE GRADE: TYPE S BELOW GRADE
CONCRETE BUILDING BRICK	ASTM C55, GRADE N (MIN. COMPRESSIVE STRENGTH ON NET AREA = 3500 PSI)
CMU GROUT	ASTM C476, (MIN. COMPRESSIVE STRENGTH AT 28 DAYS = 2000 PSI)
CMU PRISM STRENGTH	F'm = 1500 PSI PER ACI 530/ASCE 5/TMS 402 UNIT STRENGTH METHOD
HORIZONTAL JOINT REINFORCING	ASTM A82, 9 GA. GALVANIZED TRUSS TYPE U.
REINFORCING BARS	ASTM A615, GRADE 60

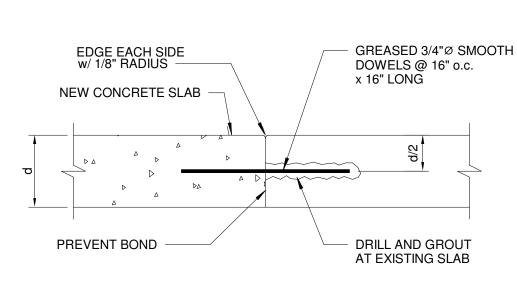
- 2. PROVIDE GALVANIZED HORIZONTAL JOINT REINFORCING IN ALL WALLS AT 16" O.C.. PROVIDE ONE-PIECE PREFABRICATED "T" AND "L" SHAPED UNITS AT 8" O.C. AT ALL WALL CORNERS AND INTERSECTIONS.
- 3. IN GROUTED AND/OR REINFORCED MASONRY WALLS, USE MASONRY UNITS WITH CORES THAT ALIGN VERTICALLY. PROVIDE CONTINUOUS UNOBSTRUCTED CELLS FOR REINFORCEMENT PLACEMENT AND GROUTING.
- 4. ALL REINFORCING STEEL SHALL BE PLACED AND TIED IN THE PROPER POSITION AS THE WALLS ARE CONSTRUCTED. LOWERING THE BARS IN FROM THE TOP OF A COMPLETED WALL OR SECTION OF WALL IS NOT ALLOWED.
- 5. LAP SPLICES FOR REINFORCING BARS SHALL BE 50 BAR DIAMETERS UNLESS NOTED OTHERWISE.
- 6. CONTRACTOR SHALL PROVIDE BRACING AND SUPPORT FOR ALL MASONRY WORK UNTIL PERMANENT ROOF FRAMING IS IN PLACE.
- 7. DO NOT APPLY UNIFORM FLOOR OR ROOF LOADS FOR AT LEAST 12 HOURS AND CONCENTRATED LOADS FOR AT LEAST 3 DAYS AFTER BUILDING MASONRY WALLS OR COLUMNS.
- 8. PROVIDE VERTICAL MASONRY CONTROL JOINTS AT APPROXIMATELY 20'-0" O.C., AND IN ACCORDANCE WITH RECOMMENDATIONS IN THE MASONRY DESIGNER'S GUIDE. REFER TO ARCHITECTURAL PLANS FOR LOCATIONS, OR IF NOT SHOWN, COORDINATE LOCATIONS WITH THE ARCHITECT.
- 9. WATERPROOFING OF THE FOUNDATION WALLS SHALL BE IN ACCORDANCE WITH ARCHITECTURAL DWG.'S AND OR SPECIFICATIONS.

# GENERAL FOUNDATION/GEOTECHNICAL NOTES

- 1. THE SOIL BEARING VALUE OF SPREAD FOOTINGS IS 2,000 PSF, AS RECOMMENDED BY AMERICAN GEOTECH, INC. 2. THE SOILS REPORT, PREPARED BY (THE SOILS ENGINEER NAME), DATED APRIL 2009 IS ON FILE WITH THE OWNER AND A COPY IS AVAILABLE FOR EXAMINATION AT THE OFFICE OF THE STRUCTURAL ENGINEER.
- 3. EXISTING FOUNDATION SIZES, ELEVATIONS, LOCATIONS, ETC., SHOWN ARE FROM ORIGINAL DRAWINGS FURNISHED
- BY THE OWNER AND MAY NOT BE THE ACTUAL CONDITIONS ENCOUNTERED.
- 4. IF REQUIRED, UNDERPINNING OF EXISTING FOOTINGS SHALL BE PERFORMED IN SUCH A MANNER SO AS TO MAINTAIN THE STRUCTURAL INTEGRITY OF THE EXISTING BUILDING.
- 5. VERIFY LOCATIONS OF COLUMNS, UNDERGROUND UTILITIES, ETC., WITH ARCHITECTURAL, MECHANICAL, ELECTRICAL,
- AND CIVIL DRAWINGS PRIOR TO PLACEMENT OF FOUNDATIONS. 6. THE BOTTOM OF ALL FOOTINGS SHALL EXTEND 1'-0" MINIMUM INTO UNDISTURBED SOIL OR ENGINEERED FILL HAVING A
- SAFE BEARING CAPACITY OF 2,000 PSF. THE BOTTOM OF ALL EXTERIOR FOOTINGS SHALL EXTEND 3'-0" BELOW FINISHED GRADE.
- 7. ALL FOUNDATION AND SLAB-ON-GRADE SUB GRADES ARE TO BE FIELD INSPECTED BY AN EXPERIENCED QUALIFIED GEOTECHNICAL ENGINEER TO VERIFY THAT THE ALLOWABLE BEARING PRESSURE IS ACHIEVED AND THAT THE SUB GRADES ARE SUITABLE FOR SUPPORT OF THE FOUNDATIONS AND SLAB-ON-GRADE. THE GEOTECHNICAL ENGINEER SHALL ALSO VERIFY FOUNDATION ELEVATIONS PRIOR TO PLACEMENT OF FOUNDATION ELEMENTS.
- 8. UNLESS DETERMINED OTHERWISE BY GEOTECHNICAL EVALUATION, FILL MATERIAL FOR SLAB AND FOOTING AREAS SHALL BE PLACED IN LAYERS NOT EXCEEDING 8 INCHES (UNCOMPACTED THICKNESS) AND COMPACTED TO 98% OF MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D698.
- 9. THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO BRACE FOUNDATION WALLS WHEN BACK FILLING AND WHEN THERE IS A POSSIBILITY OF DAMAGE BY EXCESS WATER.
- 10. COMPACTION OF BACKFILL WITHIN 2 FEET OF FOUNDATION WALLS SHALL BE ACCOMPLISHED WITH HAND EQUIPMENT. WHERE FILL IS REQUIRED ON BOTH SIDES OF FOUNDATION WALL, BRING THE FILL UP EACH SIDE SIMULTANEOUSLY
- 11. THE SURFACE AREA ADJACENT TO THE FOUNDATION WALL SHALL BE PROVIDED WITH ADEQUATE DRAINAGE AND SHALL BE GRADED SO AS TO DRAIN SURFACE WATER AWAY FROM FOUNDATION WALLS.

# STEEL ROOF DECK

- 1. STEEL ROOF DECK SHALL BE 1-1/2" THICK, 20 GAGE, WIDE RIB DECK AS CLASSIFIED BY THE STEEL DECK INSTITUTE (SDI). Fy (min) = 33,000 PSI; Fs (max) = 20,000 PSI; MAX. LL DEFLECTION = L/240.
- 2. DECK SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. INDIVIDUAL SHEETS SHALL EXTEND OVER AT LEAST 3 SPANS AND SHALL BE LAPPED OVER SUPPORTS. 3. DECK MANUFACTURER SHALL BE A MEMBER OF SDI.
- 4. GALVANIZED DECK SHALL CONFORM TO THE REQUIREMENTS OF ASTM A653 COATING CLASS G60 OR G90.



**NEW SLAB TO EXISTING** SLAB JOINT DETAIL

# GENERAL STRUCTURAL NOTES

- 1. THESE STRUCTURAL DRAWINGS ARE TO BE USED IN CONJUNCTION WITH ALL OTHER DRAWINGS, SPECIFICATIONS &
- CONTRACT DOCUMENTS. 2. THE DESIGN, CONSTRUCTION, QUALITY CONTROL AND SAFETY OF ALL WORK PERFORMED ON THE PROJECT SHALL
- CONFORM TO THE REFERENCED CODES AND STANDARDS, INCLUDING ALL SPECIFICATIONS REFERENCED WITH THE LATEST EDITIONS SHALL APPLY UNLESS NOTED.
- 3. BUILDING CODE: INTERNATIONAL BUILDING CODE 2015

DEAD LOADS: ROOFS: 15 PSF 50 PSF

(NO LIVE LOAD REDUCTIONS - SNOW DRIFT LOADS CONSIDERED WHERE 5. DESIGN LIVE LOADS: APPLICABLE ROOFS: 30 PSF

50 PSF MECHANICAL EQUIP. RM.:

6. LATERAL LOADS - WIND: MAIN WIND FORCE RESISTING SYSTEM MASONRY SHEAR WALL BASIC WIND SPEED (3-SEC GUST) 120 MPH WIND EXPOSURE CATEGORY:

WIND IMPORTANCE FACTOR: EFFECTIVE PRESSURE: EXTERNAL: 20 PSF 10 PSF INTERNAL: COMPONENTS AND CLADDING: 25 PSF

7. LATERAL LOADS - SEISMIC: SEISMIC USE GROUP: SPECTRAL RESPONSE COEFFICIENT: 0.188 0.068 SITE CLASS:

BASIC SEISMIC-FORCE-RESISTING SYSTEM: ORDINARY REINFORCED MASONRY SHEAR WALL DESIGN BASE SHEAR:

EQUIVALENT LATERAL LOAD

8. ALL INFORMATION OF EXISTING CONSTRUCTION, INCLUDING CONSTRUCTION COMPOSITION AND DIMENSIONS, WAS TAKEN FROM OWNER FURNISHED DRAWINGS OF PAST CONSTRUCTION AND SHALL BE FIELD VERIFIED. DEVIATIONS FROM THOSE SHOWN SHALL BE FURNISHED TO THE ARCHITECT AND ENGINEER.

- 9. ALL CONTRACTOR PROPOSED STRUCTURAL SUBSTITUTIONS, INCLUDING CONCRETE ADDITIVES, SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL PRIOR TO ANY PERTINENT WORK AND PRIOR TO THE AWARD OF A SUBCONTRACTOR.
- 10. SHOP DRAWINGS, TEST REPORTS, AND CERTIFICATIONS ARE REQUIRED FOR THE FOLLOWING STRUCTURAL ITEMS:
- A. CONCRETE MIX DESIGNS
- B. CONCRETE CYLINDER TESTS
- C. GROUT MIX DESIGNS D. REINFORCING STEEL SHOP DRAWINGS
- E. MISCELLANEOUS AND STRUCTURAL STEEL SHOP DRAWINGS F. STEEL ROOF DECK SHOP DRAWINGS
- G. CONCRETE MASONRY UNIT CERTIFICATION AND DATA H. MORTAR CERTIFICATION AND DATA
- I. WALL REINFORCING DATA J. UNDERPINNING METHOD AND SEQUENCING (IF REQUIRED)

ANALYSIS PROCEDURE:

- 11. CONSTRUCTION METHODS, PROCEDURES, AND SEQUENCES ARE THE RESPONSIBILITY OF THE CONTRACTOR. THE
- CONTRACTOR SHALL TAKE ALL NECESSARY MEANS TO MAINTAIN AND PROTECT THE STRUCTURAL INTEGRITY OF ALL CONSTRUCTION AT ALL STAGES.
- 12. COORDINATION WITH THE ARCHITECTURAL, MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS TO VERIFY THE LOCATIONS AND SIZES OF ALL CHASES, INSERTS, OPENINGS, SLEEVES, FINISHES, DEPRESSIONS, AND OTHER PROJECT
- REQUIREMENTS ARE THE CONTRACTOR'S RESPONSIBILITY. ALL REQUIRED OPENINGS, SLEEVES, OR OTHER COMPONENTS MAY NOT BE SHOWN ON THE STRUCTURAL DRAWINGS.
- 13. IMPOSED CONSTRUCTION LOADS, INCLUDING CRANE LOADS, IN EXCESS OF THE STATED DESIGN LOADS MUST BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO THE IMPOSITION OF SUCH LOADS.
- 14. IMPLEMENTING JOB SITE SAFETY AND CONSTRUCTION PROCEDURES ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
- 15. IN CASE OF CONFLICT BETWEEN THE GENERAL NOTES, DETAILS AND SPECIFICATIONS, THE MOST RIGID REQUIREMENTS 16. EXISTING SITE UTILITIES ARE SHOWN TO INDICATE GENERAL LOCATION AND MAY NOT SHOW ALL EXISTING SITE UTILITIES.
- FEILD VERIFY LOCATION AND DEPTH OF ALL EXISTING SITE UTILITIES. 17. CONTRACTOR SHALL USE EXTREME CARE OF WORKING NEAR EXISTING SITE UTILITIES.
- 18. CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION. EXISTING UTILITIES WHICH ARE NOT TO BE REMOVED OR ABANDONED SHALL REMAIN OPERATIONAL AT ALL TIMES. ANY DAMAGED DEVICES SHALL BE REPAIRED OR REPLACED AT THE END OF WORK DAY BEFORE LEAVING THE SITE. PIER FOOTINGS WILL REQUIRE CAUTION TO AVOID HIGH VOLTAGE UNDERGROUND ELECTRICAL LIVES.

# STRUCTURAL STEEL

- 1. ALL MATERIALS AND WORKMANSHIP SHALL COMPLY WITH THE REQUIREMENTS OF THE FOLLOWING CODES
- AND STANDARDS: "MANUAL OF STEEL CONSTRUCTION - AISC 325-11 FOURTEENTH EDITION, 2010, AMERICAN INSTITUTE OF STEEL CONSTRUCTION (INCLUDING SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS,
- SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS, AND AISC CODE OF STANDARD PRACTICE).
- "DETAILING FOR STEEL CONSTRUCTION" AISC 326-09, AMERICAN INSTITUTE OF STEEL CONSTRUCTION. "STRUCTURAL WELDING CODE ANSI/AWS D1.1/D1.1M", AMERICAN WELDING SOCIETY. W SHAPES
- PLATES & OTHER SHAPES ASTM A36 STRUCTURAL TUBING ASTM A500, GRADE B, Fy = 46 ksi
- ASTM A53, GRADE B, Fy=35 KSI OR ASTM A501, Fy=36 KSI STRUCTURAL PIPE HIGH-STRENGTH BOLTS ASTM A325-N ANCHOR RODS ASTM F1554 THREADED ROD ASTM A36

HILTI KWIK-BOLT III, ITW RAMSET/REDHEAD TRU-BOLT

OR APPROVED EQUAL, U.N.O.

- HEADED SHEAR STUDS ASTM A108 WELDING ELECTRODES AWS A5.1 OR A5.5 E70XX
- HILTI HIT HY200 SYSTEM, ITW RAMSET/REDHEAD EPCON SYSTEM OR APPROVED EQUAL, U.N.O. 2. ALL SHOP AND FIELD CONNECTIONS SHALL BE MADE WITH HIGH STRENGTH BOLTS OR WELDS. ALL BOLTS AND NUTS SHALL BE CLEARLY MARKED AS REQUIRED BY AISC SPECIFICATIONS. ALL CONNECTIONS MADE
- WITH UNMARKED NUTS AND BOLTS WILL BE REJECTED. ALL BOLTED CONNECTIONS SHALL HAVE A MINIMUM OF 2 BOLTS. 3. ALL CONNECTIONS SHALL CONFORM TO AISC REQUIREMENTS AND SHALL BE DESIGNED FOR 100% OF THE MAXIMUM WEB SHEAR INDICATED IN THE AISC MANUAL OF STEEL CONSTRUCTION AISC 325-11 14TH EDITION "MAXIMUM
- TOTAL UNIFORM LOADS ON BEAMS", PAGES 3-33 TO 3-95. 4. ALL STEEL AT AND BELOW FINISHED GRADE OR FLOOR SLAB SHALL RECEIVE TWO COATS OF BITUMINOUS PAINT OR 3" MINIMUM CONCRETE COVER.
- 5. THE GENERAL CONTRACTOR SHALL NOTIFY THE STRUCTURAL ENGINEER OF ANY FABRICATION OR ERECTION ERRORS OR DEVIATIONS AND RECEIVE WRITTEN APPROVAL BEFORE ANY FIELD CORRECTIONS ARE MADE. 6. THE FRAMING SHOWN ON THE COMPLETED DRAWINGS HAS BEEN DESIGNED FOR THE LOADS INDICATED ON THE DRAWINGS. THE FABRICATOR AND ERECTOR ARE SOLELY RESPONSIBLE FOR THE DESIGN OF TEMPORARY BRACING AND RECOMMENDED
- ERECTION PROCEDURES.
- 7. CUTTING OR BURNING OF STRUCTURAL STEEL IN THE FIELD IS NOT ALLOWED, UNLESS BY WRITTEN APPROVAL BY ENGINEER. 8. ONE SHOP COAT OF PAINT SHALL BE APPLIED TO ALL STRUCTURAL MEMBERS EXCEPT:
- A. MEMBERS ENCASED IN CONCRETE.

EXPANSION BOLTS

ADHESIVE ANCHORS

- B. MEMBERS RECEIVING SPRAY FIREPROOFING. C. SURFACES TO BE FIELD WELDED.
- D. GALVANIZED SURFACES. 9. THE STEEL FABRICATOR SHALL DESIGN ALL STEEL TO STEEL CONNECTIONS NOT SHOWN ON THE DRAWINGS.
- 10. ALL STEEL LINTELS IN EXTERIOR WALLS SHALL BE GALVANIZED.
- 11. FOR MISCELLANEOUS STEEL NOT SHOWN ON THESE DRAWINGS, SEE ARCHITECTURAL AND OTHER ENGINEERING DRAWINGS. 12. CONTRACTOR AND ERECTOR ARE RESPONSIBLE FOR COMPLYING WITH ALL OSHA REGULATIONS.

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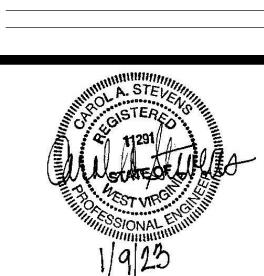
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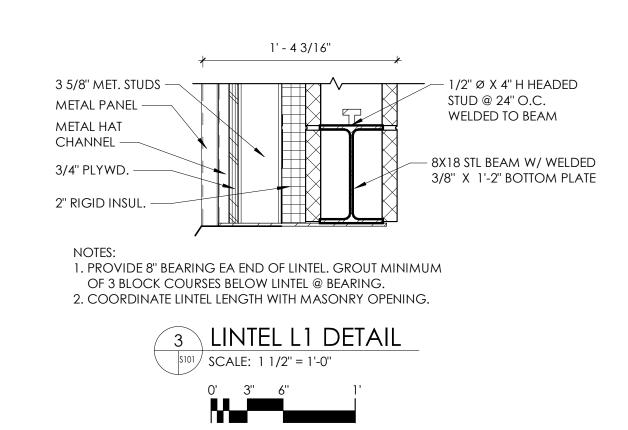
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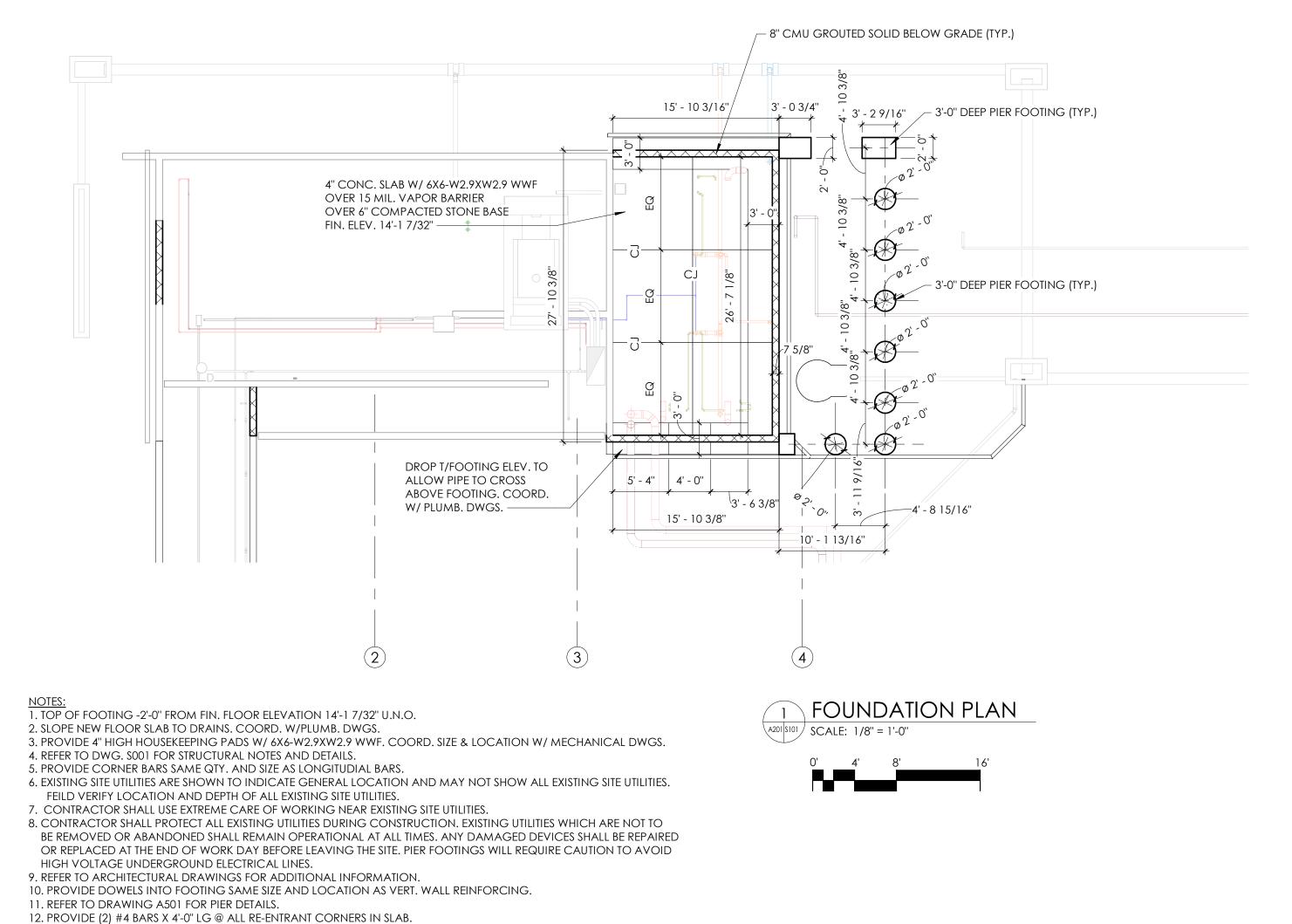
DRAWING TITLE: STRUCTURAL NOTES & TYPICAL DETAILS

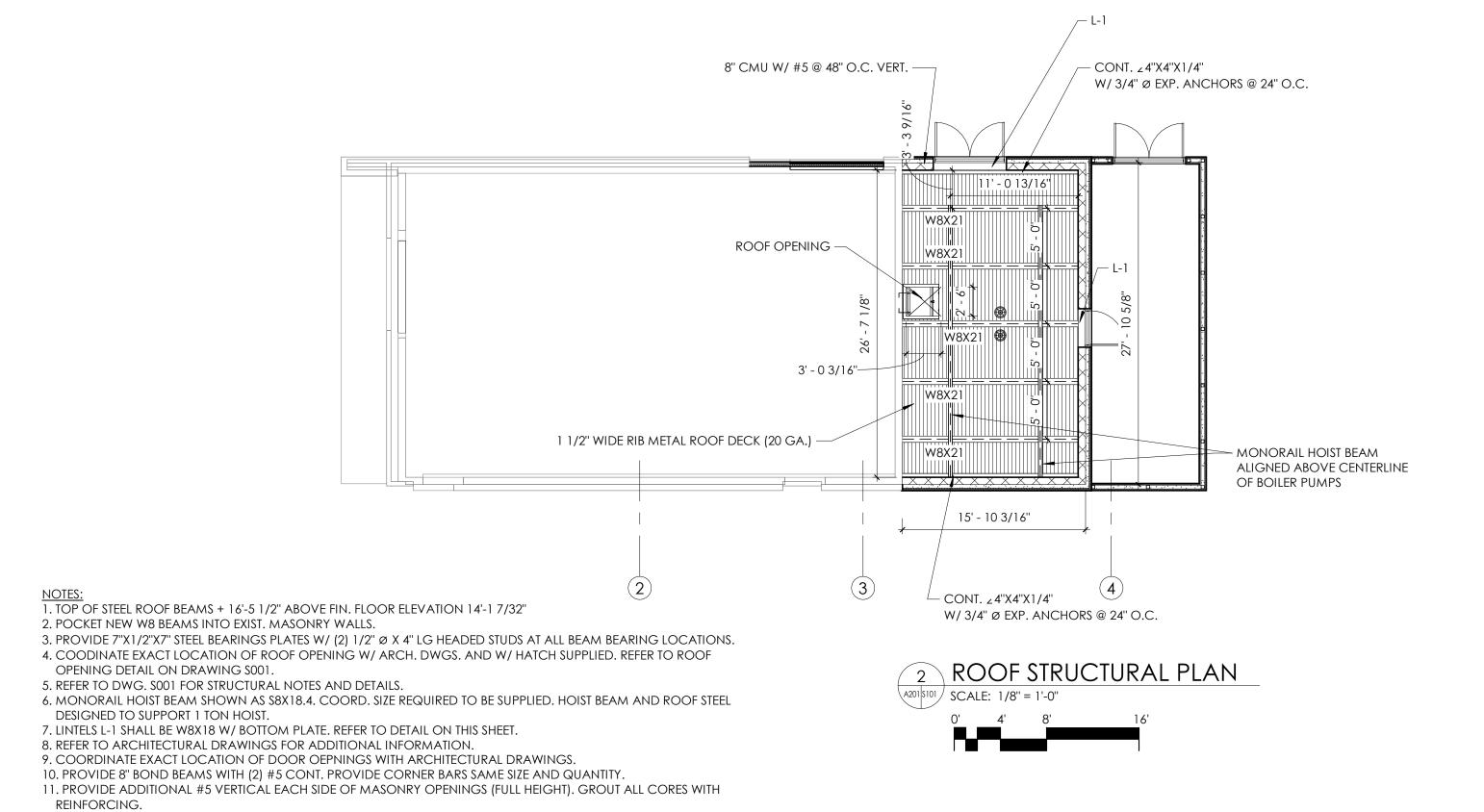
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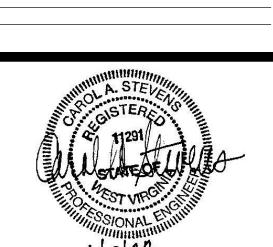
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PROJECT NAME:
Building #3 Hydronic Boiler
System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

DRAWING TITLE:
STRUCTURAL PLANS

FILE: XXX

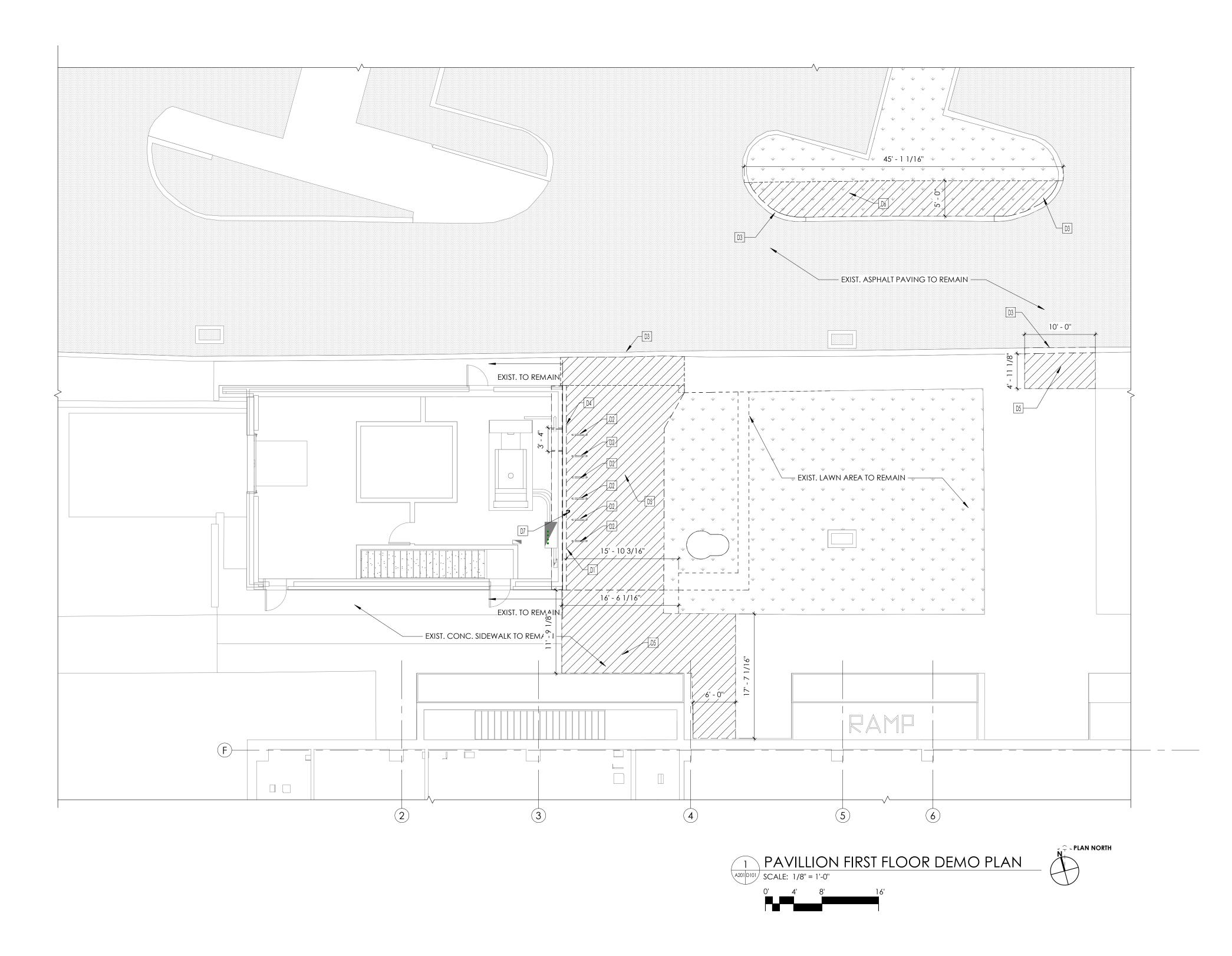
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**S101** 



CONSTRUCTION NOTES (PER SHEET)

D1 REMOVE & DISPOSE OF EXIST. METAL WALL PANEL SYSTEM

D2 REMOVE & DISPOSE OF EXIST. S/S BIKE RACK
D3 REMOVE & DISPOSE OF EXIST. CONCRETE CURB

D4 REMOVE & STORE EXIST. STONE PANEL.

D5 REMOVE & DISPOSE OF PORTION OF EXIST. CONCRETE SIDEWALK

D6 REMOVE EXIST. TOPSOIL & INFILL LOW AREAS OF PARKING LOT MEDIA

D6 REMOVE EXIST. TOPSOIL & INFILL LOW AREAS OF PARKING LOT MEDIANS.
OWNER TO DETERMINE LOCATIONS.
D7 EXIST. HOSE BIB - SEE PLUMB. DWGS.

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PROJECT NAME:

JAMES BRIAN SWIGER NO. 3640

Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

DEMO PLAN

FILE: XXX

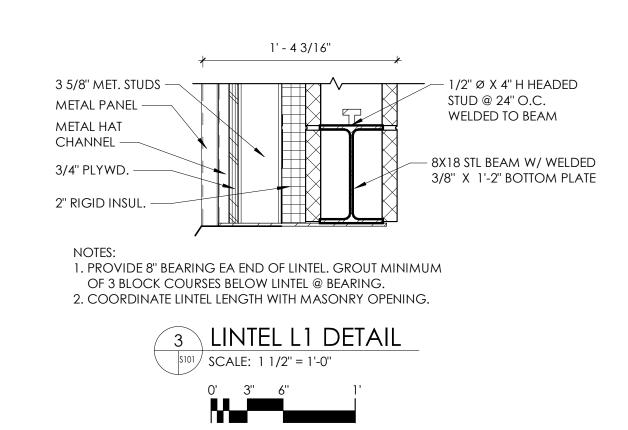
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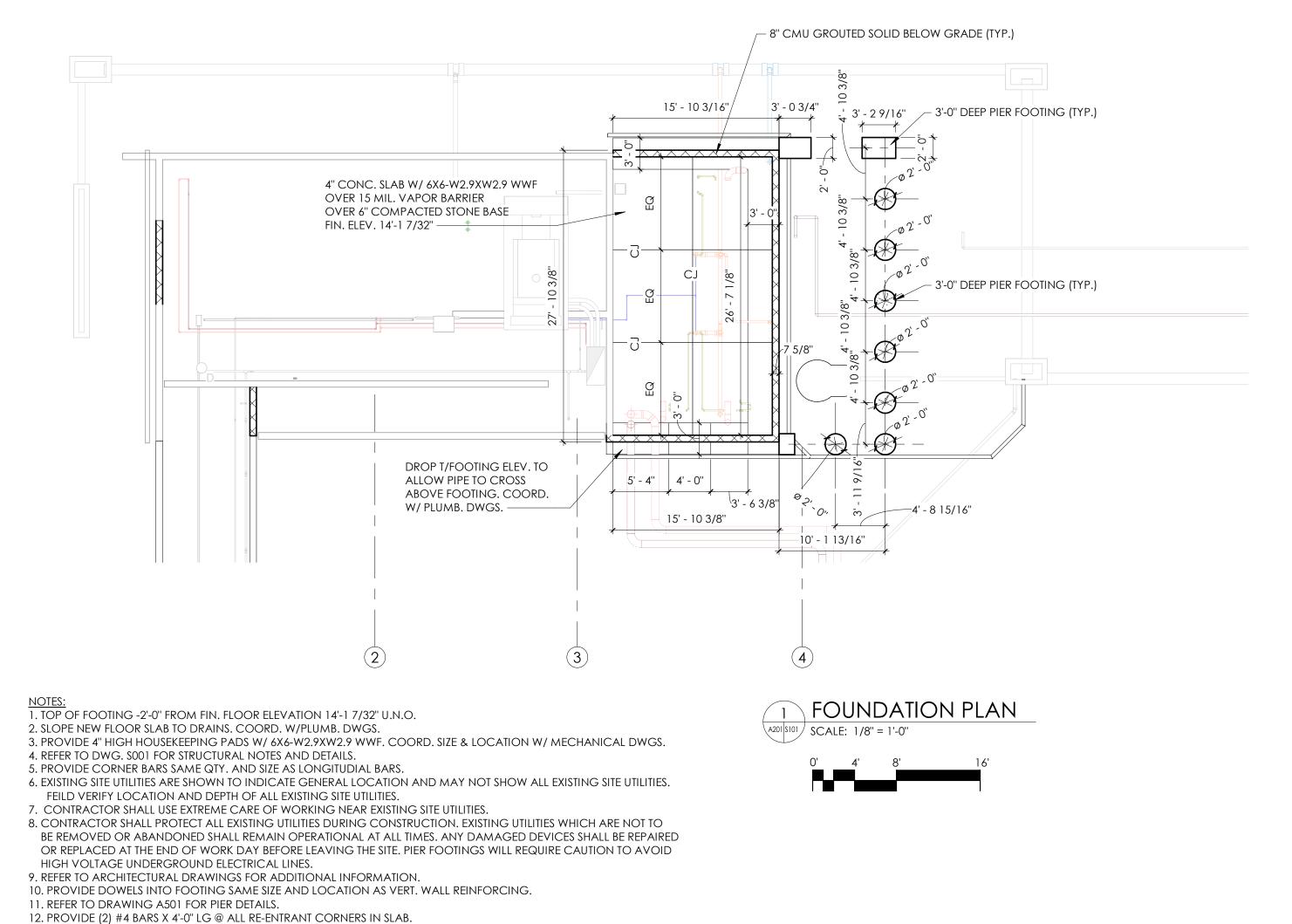
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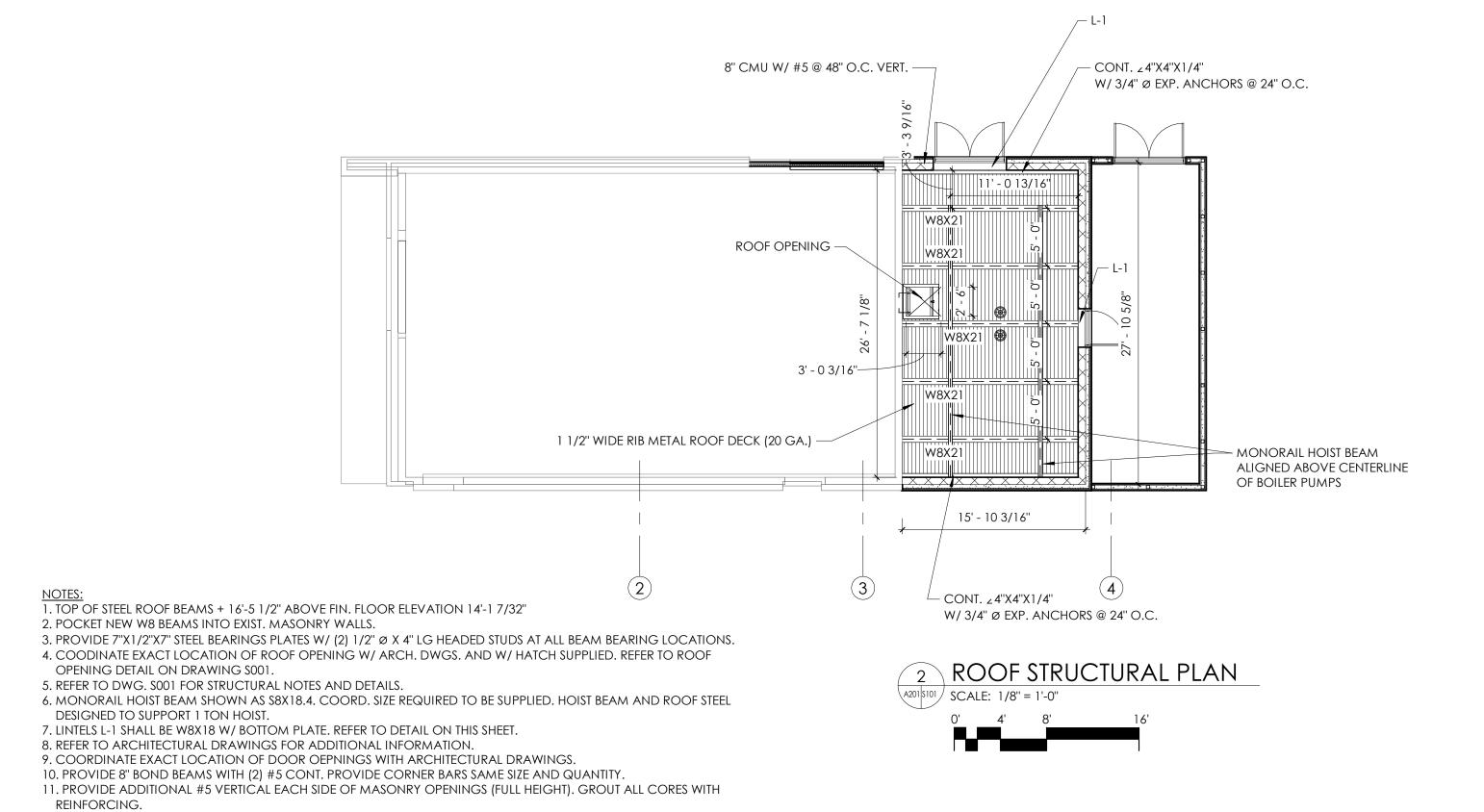
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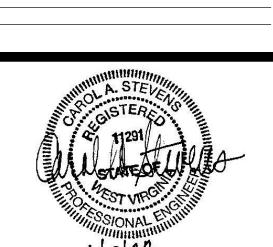
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DRAWING TITLE:
STRUCTURAL PLANS

FILE: XXX

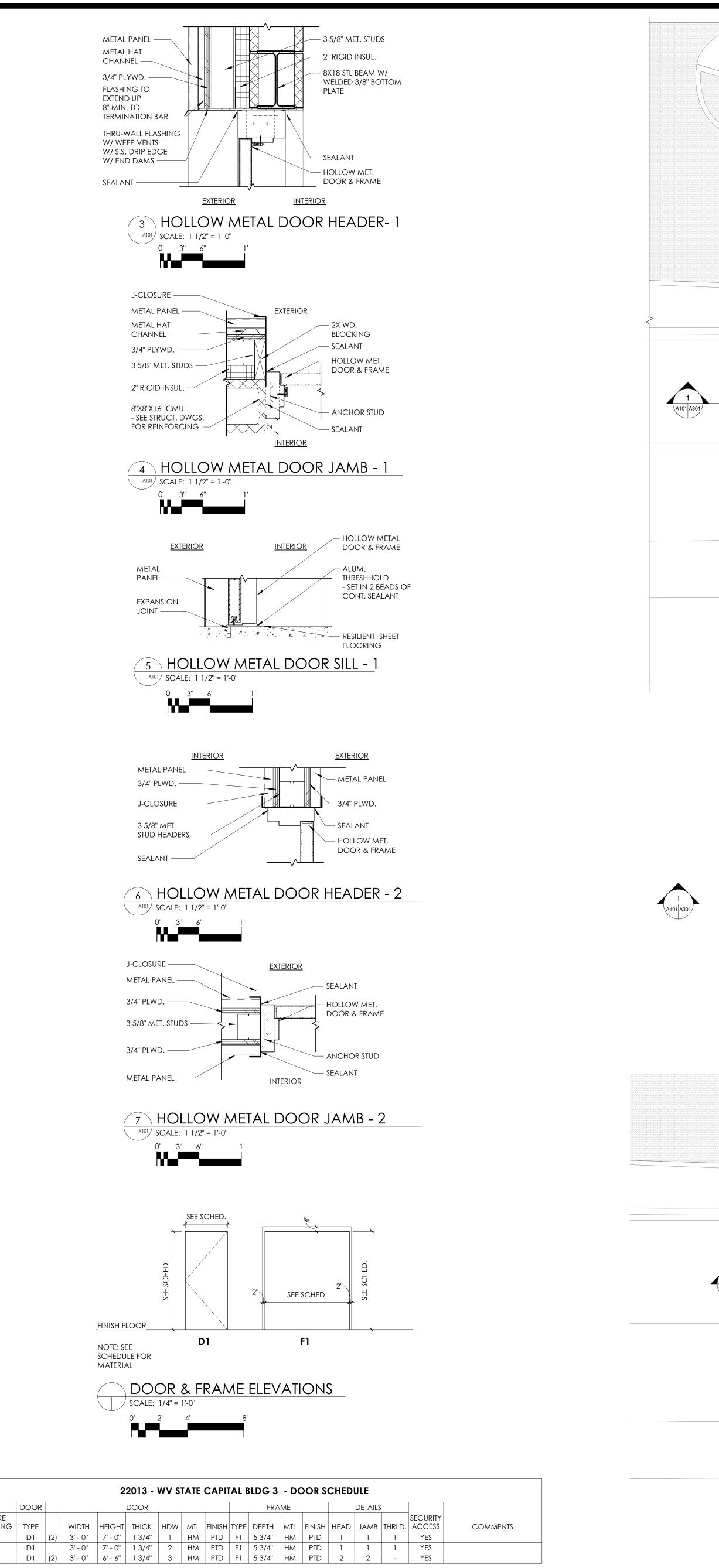
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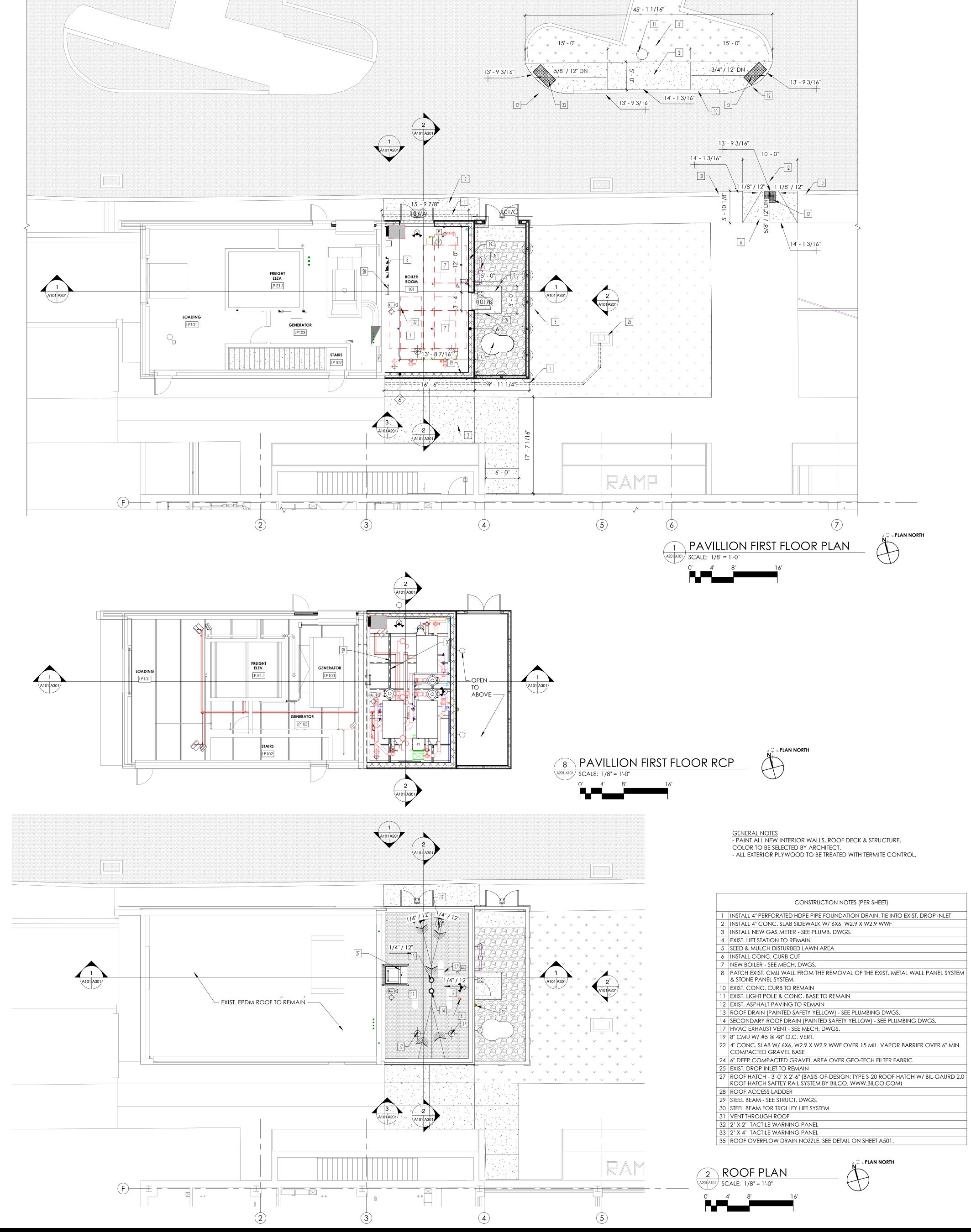
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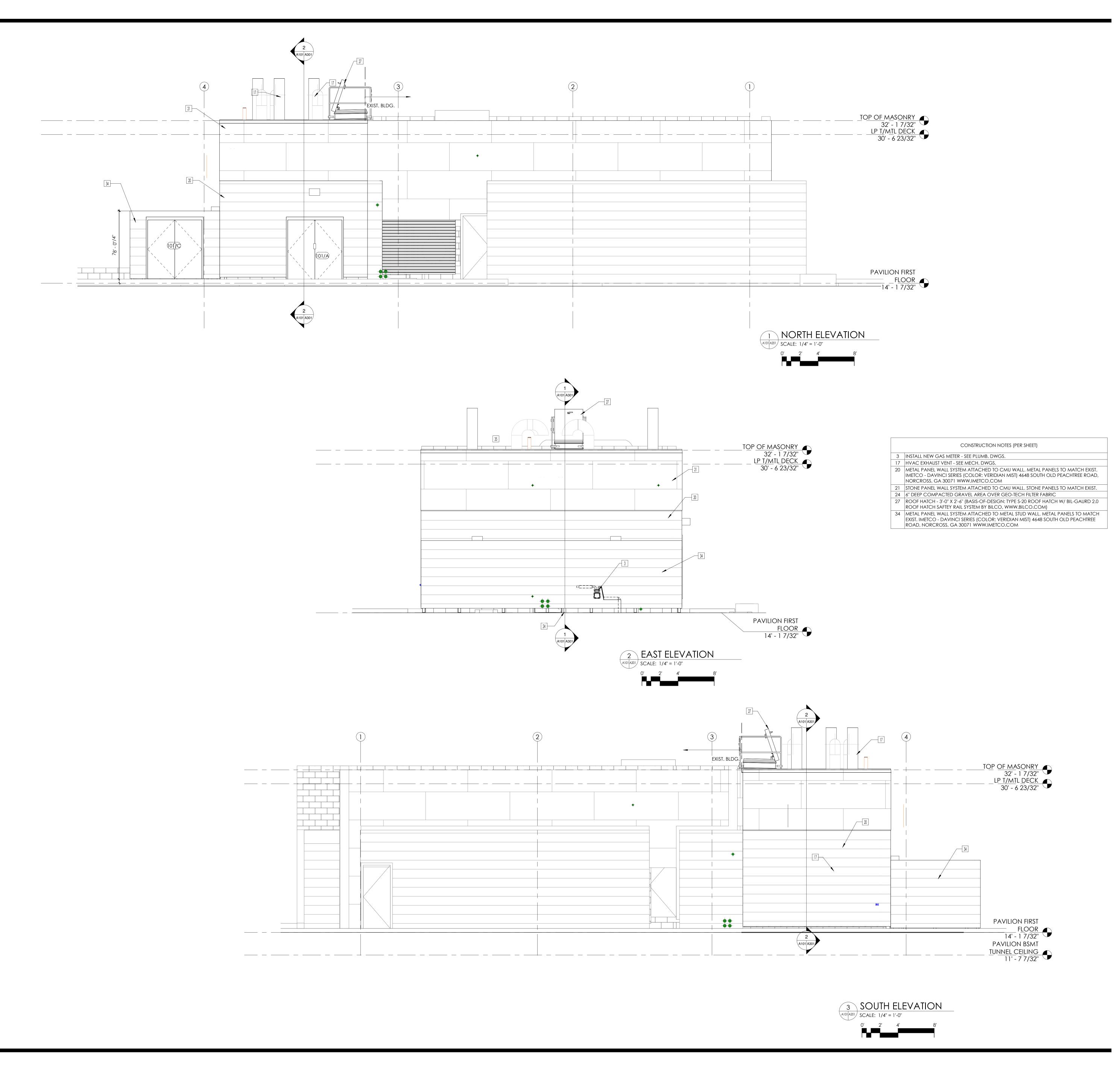
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DRAWING TITLE: PLANS, SCHEDULE & **DETAILS** 

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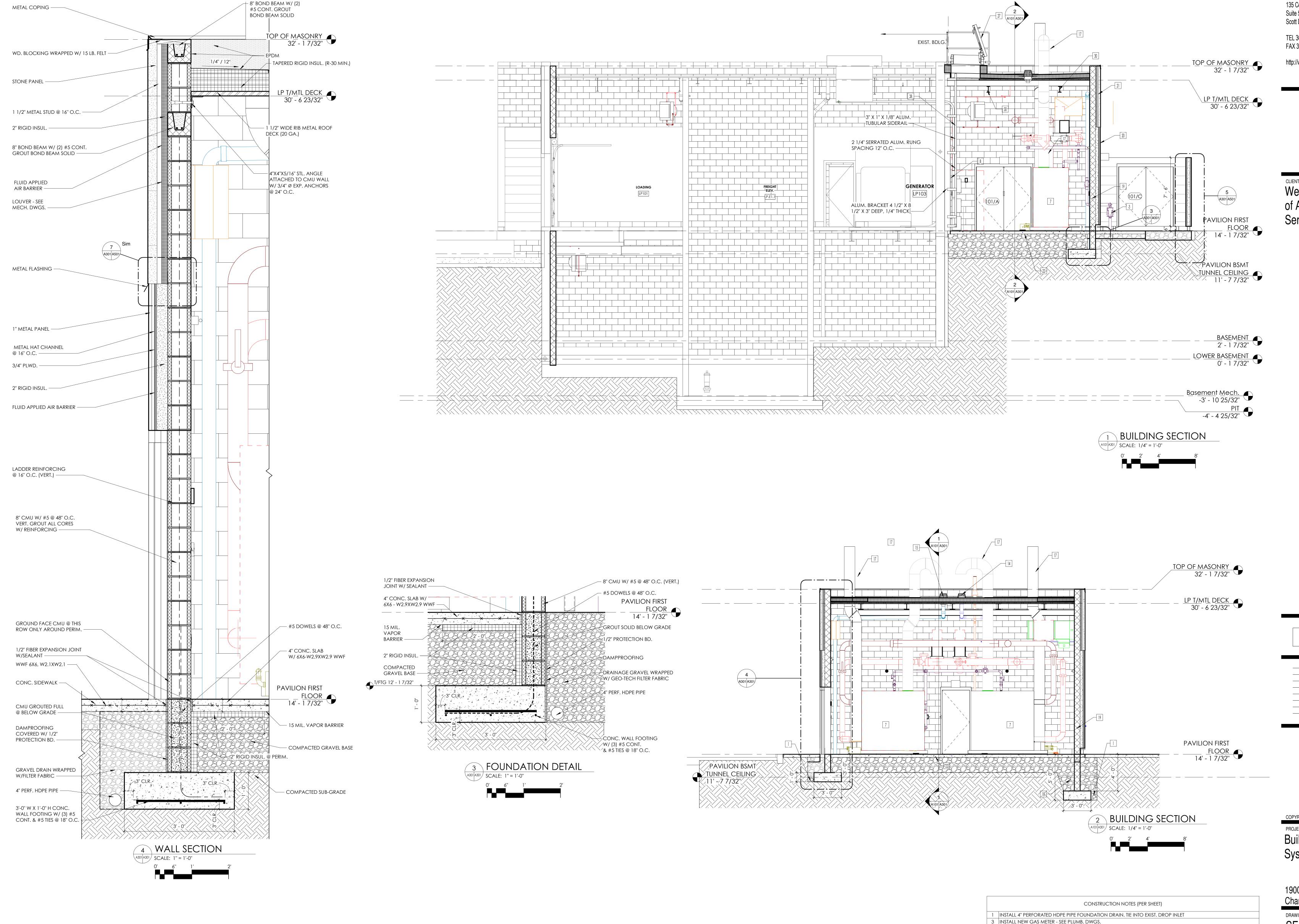
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DRAWING TITLE: **EXTERIOR ELEVATION** 

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DRAWING TITLE:
SECTIONS

8 PATCH EXIST. CMU WALL FROM THE REMOVAL OF THE EXIST. METAL WALL PANEL SYSTEM & STONE PANEL SYSTEM.

20 METAL PANEL WALL SYSTEM ATTACHED TO CMU WALL, METAL PANELS TO MATCH EXIST, IMETCO - DAVINCI SERIES (COLOR: VERIDIAN MIST) 4648 SOUTH OLD PEACHTREE ROAD, NORCROSS, GA 30071 WWW.IMETCO.COM

22 4" CONC. SLAB W/ 6X6, W2.9 X W2.9 WWF OVER 15 MIL. VAPOR BARRIER OVER 6" MIN. COMPACTED GRAVEL BASE

27 ROOF HATCH - 3'-0" X 2'-6" (BASIS-OF-DESIGN: TYPE S-20 ROOF HATCH W/ BIL-GAURD 2.0 ROOF HATCH SAFTEY RAIL

14 SECONDARY ROOF DRAIN (PAINTED SAFETY YELLOW) - SEE PLUMBING DWGS.

17 HVAC EXHAUST VENT - SEE MECH. DWGS.
18 REINFORCED CONC. FOUNDATION
19 8" CMU W/ #5 @ 48" O.C. VERT.

SYSTEM BY BILCO, WWW.BILCO.COM)

30 STEEL BEAM FOR TROLLEY LIFT SYSTEM

28 ROOF ACCESS LADDER

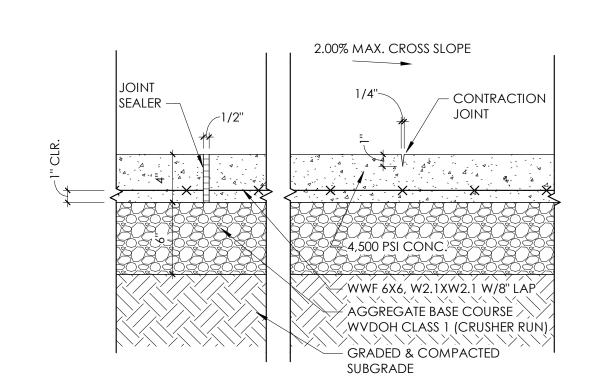
15 EPDM OVER 5" TAPERED RIGID INSUL. OVER 1 1/2" METAL DECK OVER STEEL STRUCTURE

21 STONE PANEL WALL SYSTEM ATTACHED TO CMU WALL. STONE PANELS TO MATCH EXIST.

FILE: XXX
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CHECKED BY:JBS
PROJ. NO: GSD-221-C

DRAWING NO:

A301



NOTES:

1. ALL MATERIALS & METHODS OF CONSTRUCTION SHALL CONFORM TO THE APPLICABLE REQUIREMNTS OF THE WYDOH STANDARD SPECIFICATIONS, ROADS & BRIDGES, LATEST EDITION AND THE SUPPLEMENTAL SPECIFICATIONS, LATEST EDITION.

2. CONTRACTION JOINTS SHALL CONSTRUCTED @ 5'-0"

LATEST EDITION.

2. CONTRACTION JOINTS SHALL CONSTRUCTED @ 5'-0"
INTERVALS,@ ALL RETURNS & OPPOSITE CONTRACTION
JOINTS IN ADJACENT CURB. CONTRACTION JOINTS SHALL
BE FILLED WITH PREFORMED JOINT FILL WHICH SHALL BE
SHAPED TO FIT THE CONCRETE SECTION BEING PLACED.

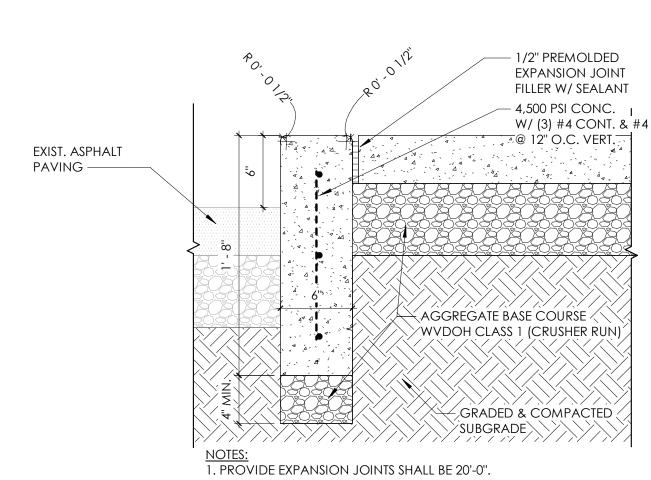
3. MAXIUM SPACING BETWEEN EXPANSION JOINTS SHALL
BE 20'-0".

SHAPED TO FIT THE CONCRETE SECTION BEING PLACED

3. MAXIUM SPACING BETWEEN EXPANSION JOINTS SHA
BE 20'-0".

4. WHERE SIDEWALKS ARE TO BE PLACED AROUND OR
ADJACENT TO MANHOLES, DROP INLETS OR OTHER
MISCELLANEOUS STRUCTURES. EXPANSION JOINTS, AS
DESCRIBED ABOVE, SHALL BE CONSTRUCTED BETWEEN
SUCH APPURTENANCES & THE SIDEWALK.

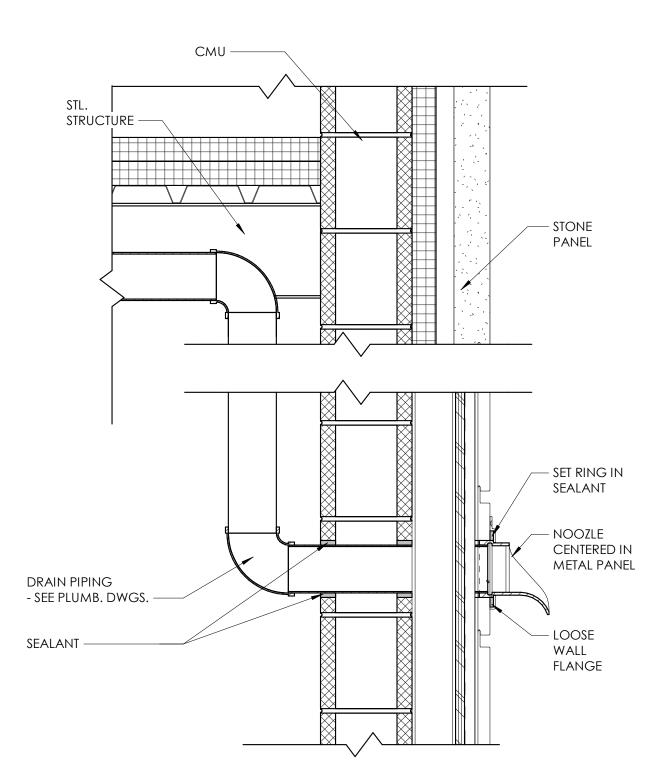




6 CONCRETE CURB

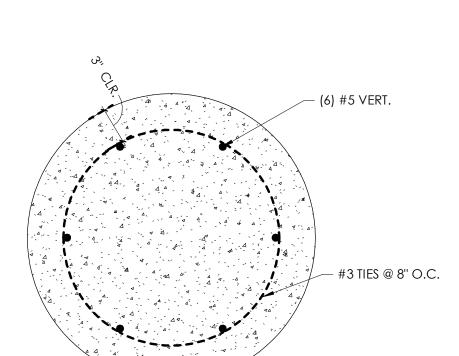
A501 SCALE: 1 1/2" = 1'-0"

0' 3" 6"



8 OVERFLOW DRAIN DETAIL

SCALE: 1 1/2" = 1'-0"

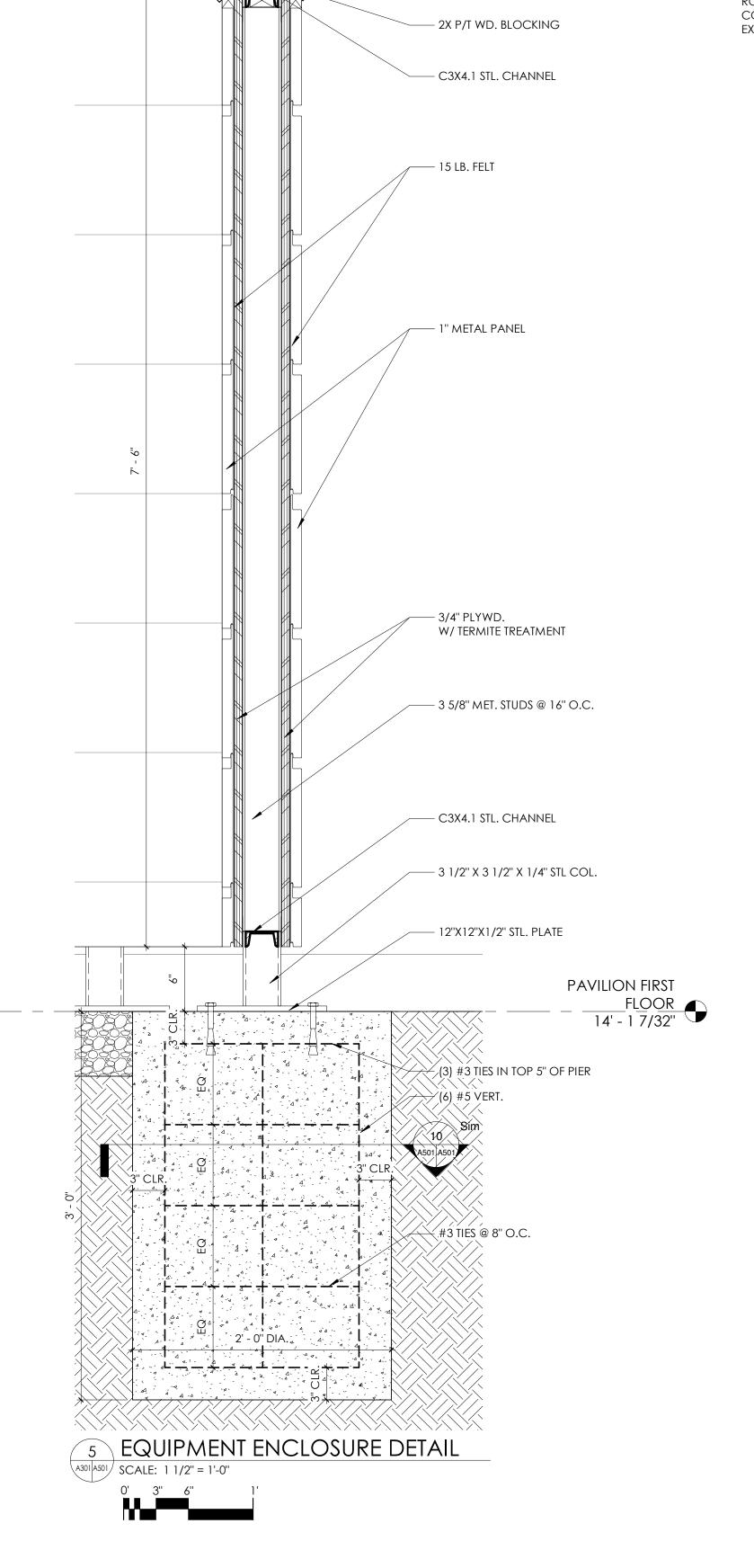


— 2'-0" DIA. PIER

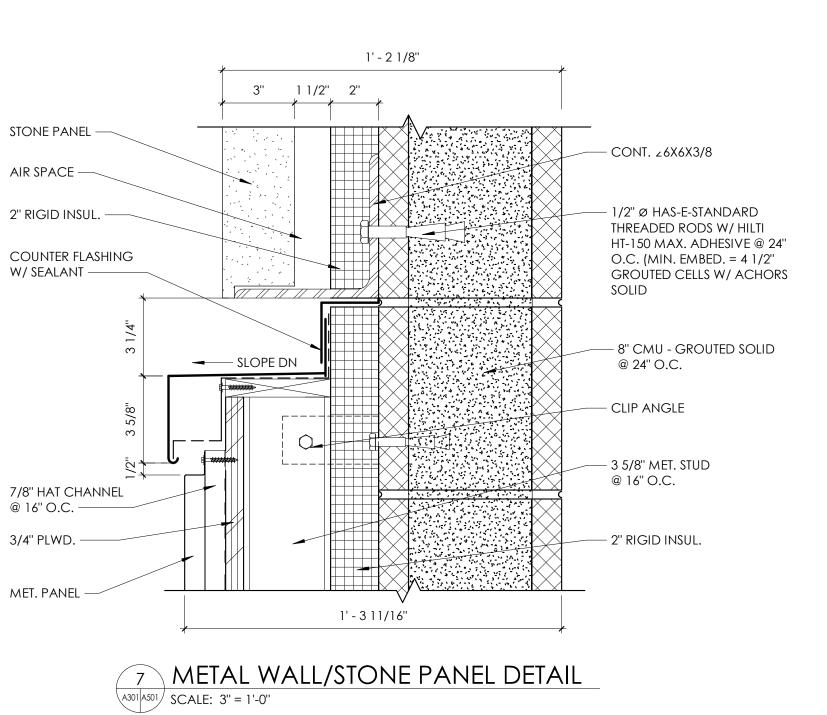
10 PIER PLAN DETAIL

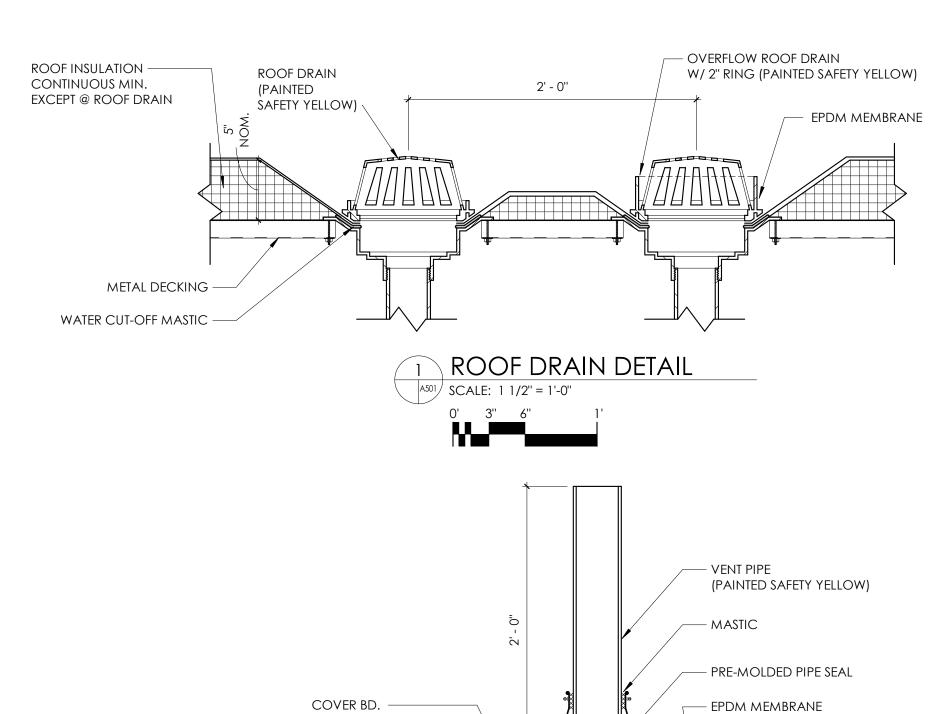
SCALE: 1 1/2" = 1'-0"

0' 3" 6" 1'



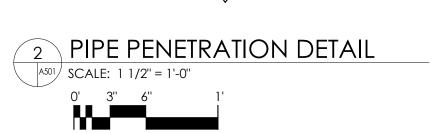
- METAL COPING W/ CLEATS

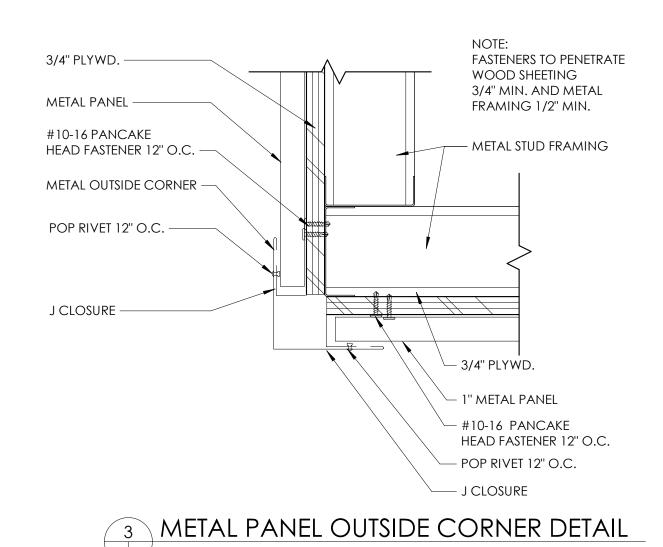


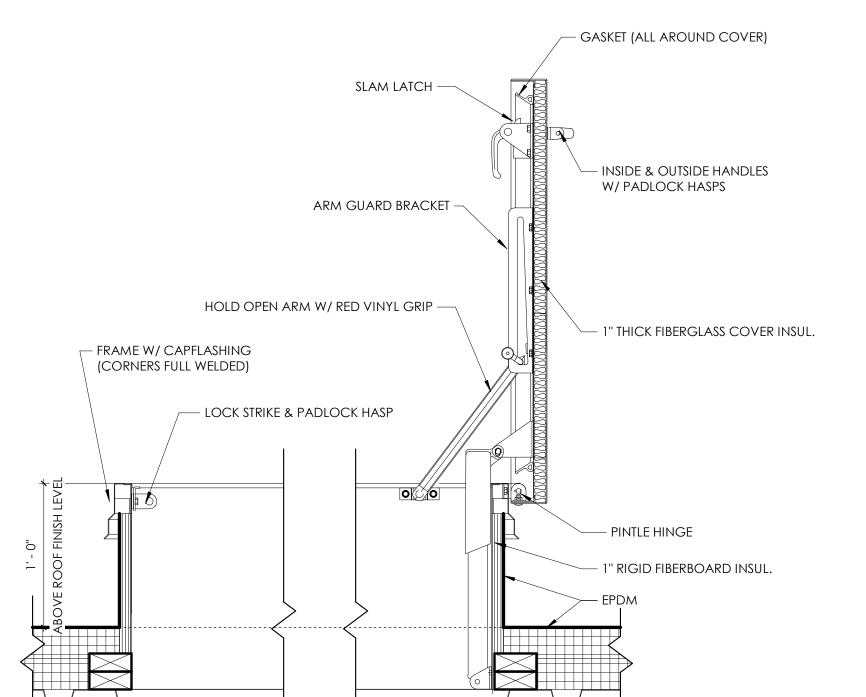


ROOF INSULATION

METAL DECKING —







4 ROOF HATCH DETAIL

A501 SCALE: 1 1/2" = 1'-0"

0' 3" 6" 1'

\_\_\_\_∠4"X4"X1/4"

135 Corporate Center Drive
Suite 532,
Scott Depot, WV 25560

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West Virginia Department of Administration General Services Division

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NO DATE REVISION

JAMES BRIAN Z

SWIGER

NO. 3640

01/09/23
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Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

DETAILS

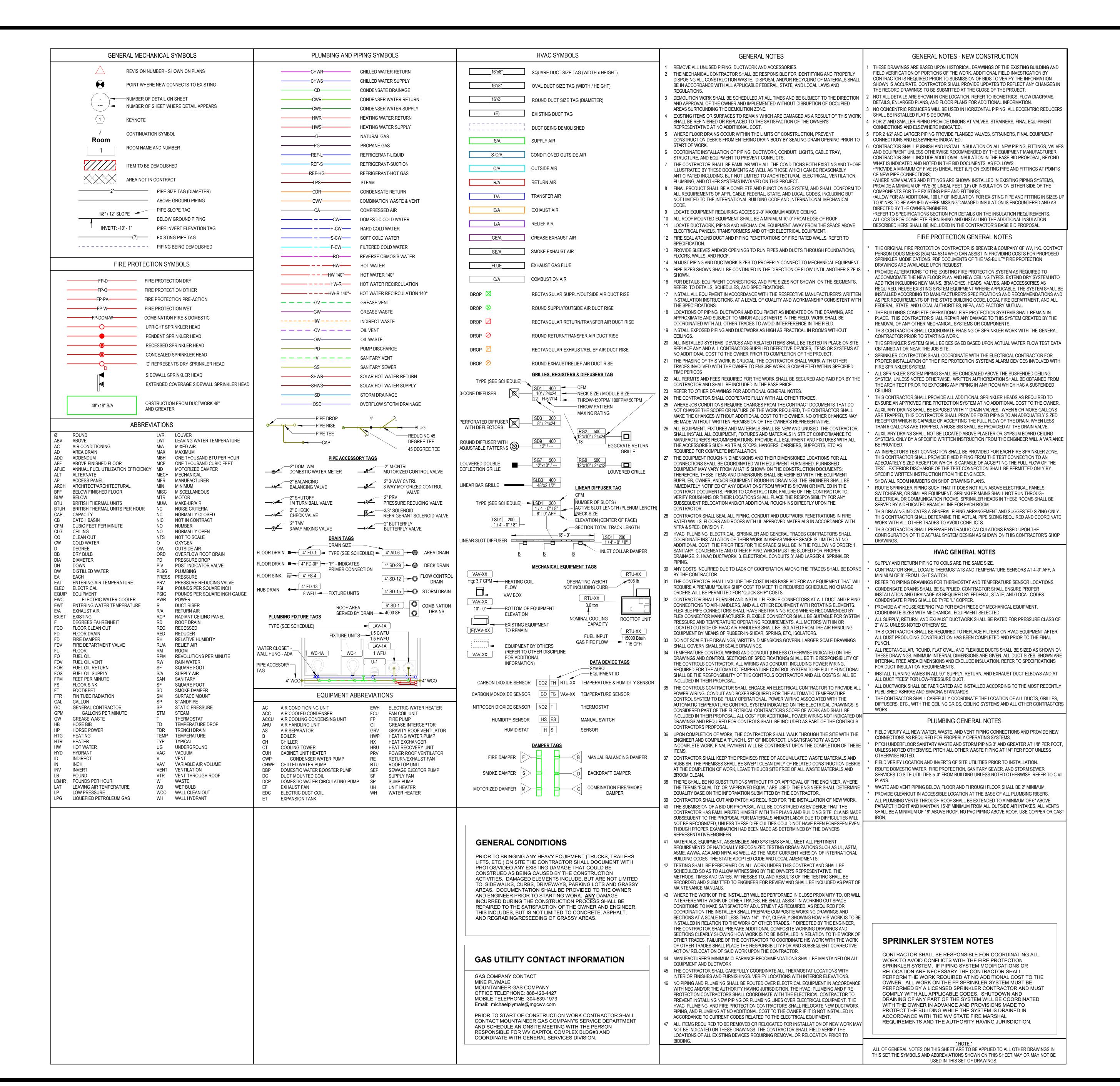
FILE: XXX

DRAWN BY: SMK

CHECKED BY:JBS

PROJ. NO: GSD-221-C

DRAWING NO:



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West Virginia Department of Administration General

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Title Sheet Revision

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PROJECT NAME: Building #3 Hydronic Boiler Syster Upgrades

1900 Kanawha Boulevard East Charleston, WV 25305

DRAWING TITLE: MECHANICAL TITLE

FILE: XXX DRAWN BY: VB CHECKED BY:TZ3 PROJ. NO: GSD-221-0

DRAWING NO:

BUILDING 3 BASEMENT STEAM DEMOLITION PLAN
1/4" = 1'-0"

## MECHANICAL DEMOLITION GENERAL NOTES

IF DURING CONSTRUCTION OF THIS PROJECT, WORK INVOLVING HAZARDOUS MATERIALS IS SUSPECTED OR ENCOUNTERED ALL WORK IN THIS AREA SHALL BE DISCONTINUED AND THE OWNER'S REPRESENTATIVE SHALL BE NOTIFIED IMMEDIATELY AND THE OWNER WITH HIS OWN FORCES OR BY SEPARATE CONTRACT SHALL BE RESPONSIBLE FOR COMPLETE INVESTIGATION, REMOVAL, AND DISPOSAL OF THE HAZARDOUS MATERIALS IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS. IF COSTS ARE INVOLVED BECAUSE OF SUCH ACTION BY THE OWNER: CONTRACTOR SHALL FILE CLAIM AS PROVIDED ELSEWHERE IN THE CONTRACT DOCUMENTS.

CONTRACTOR SHALL REMOVE EXISTING CEILINGS AND ALL CEILING MOUNTED EQUIPMENT, DEVICES, ETC. AS REQUIRED FOR NEW WORK. RELOCATE OR REPLACE AS NECESSARY TO MAINTAIN FULLY OPERATIONAL SYSTEMS AS THEY CURRENTLY EXIST. ANY REQUIRED REMOVAL, RELOCATION OR REPLACEMENT OF EXISTING CONDUIT, PIPING, DUCTWORK SYSTEMS, WIRING, ETC. RELATED TO COMPLETING THIS PROJECT SHALL BE INCLUDED IN BASE BID PROPOSAL AT NO ADDITIONAL COST TO THE OWNER.

CONTRACTOR SHALL PATCH AND PAINT TO MATCH EXISTING ADJACENT FINISHES ON ALL EXISTING WALLS, FLOORS, CEILINGS, AND SURFACES WHERE AREAS ARE EXPOSED DURING DEMOLITION WORK INCLUDING, BUT NOT LIMITED TO, AREAS BEHIND HVAC EQUIPMENT, PIPES, DUCTWORK, TRANSFER GRILLES ETC THAT WERE REMOVED.

- CONTRACTOR SHALL SCHEDULE ALL WORK WITH THE OWNER'S REPRESENTATIVE PRIOR TO START OF CONSTRUCTION TO ENSURE ADJACENT AREAS REMAIN IN OPERATION AS REQUIRED. 5 ALL ITEMS REQUIRED TO BE REMOVED OR RELOCATED FOR INSTALLATION OF NEW WORK MAY NOT BE INDICATED ON THESE DRAWINGS. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATIONS OF ALL EXISTING DEVICES REQUIRING REMOVAL OR RELOCATION PRIOR TO BIDDING AND INCLUDE COSTS IN BASE BID PROPOSAL.
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- DEMOLITION WORK SHALL BE SCHEDULED AT ALL TIMES AND BE SUBJECT TO THE DIRECTION AND APPROVAL OF THE OWNER AND IMPLEMENTED WITHOUT DISRUPTION OF OCCUPIED AREAS SURROUNDING THE DEMOLITION ZONE. PRIOR TO ANY DEMOLITION, THE GENERAL CONTRACTOR SHALL COORDINATE BRACING TO MAINTAIN THE STRUCTURAL INTEGRITY OF THE REMAINING ELEMENTS OF THE BUILDING AS REQUIRED.

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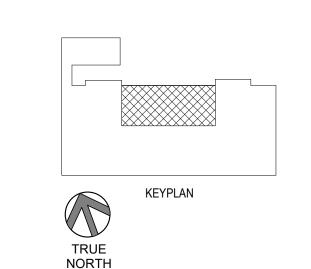
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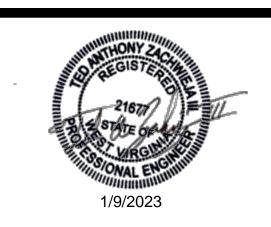
West Virginia Department of Administration General Services Division

# **KEYNOTES**

- HIGH PRESSURE STEAM CONTINUES TO MH-3 AND PUMPED CONDENSATE CONTINUES TO BASEMENT OF BLDG #5
- 2 6" SAFETY PRESSURE RELIEF VENT ROUTED TO THE EXTERIOR.
- VENT THAT CONTINUES UP THROUGH FACILITY.
- CONTRACTOR SHALL CAP AND FINISH THE INSIDE WALL. PAINT THE WATER STAINS TO MATCH EXISTING.
- CONTRACTOR SHALL REMOVE CONDENSATE RECEIVING TANK AND PUMPS AND TURN OVER TO OWNER. CONTRACTOR SHALL REMOVE STEAM TO HOT WATER HEAT EXCHANGER AND
- TURN OVER TO OWNER. CONTRACTOR SHALL REMOVE SPARE STEAM TO HOT WATER HEAT EXCHANGER TUBE BUNDLE AND TURN OVER TO OWNER.
- CONTRACTOR SHALL REMOVE STEAM PRESSURE REDUCING VALVES AND TURN



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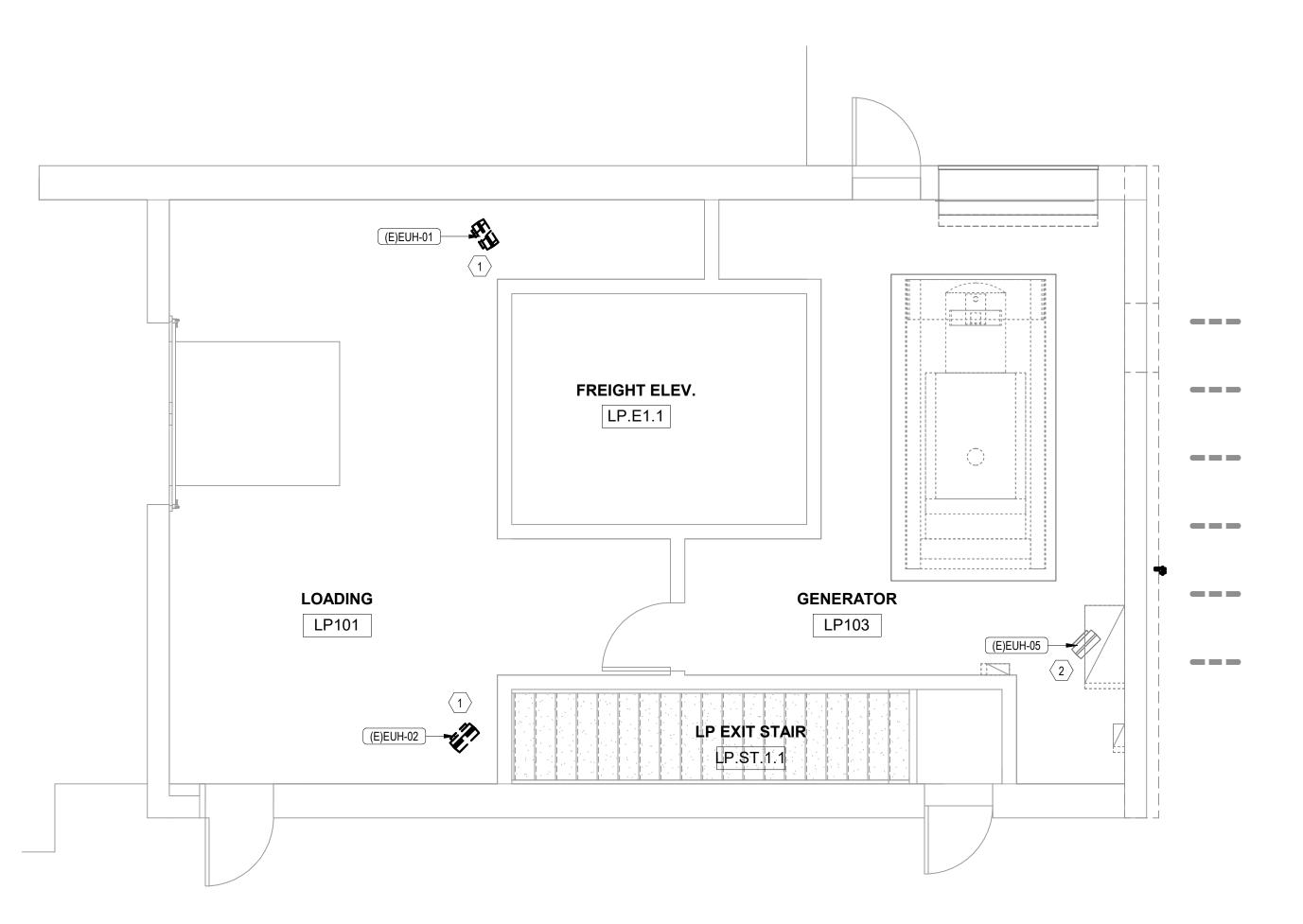
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PROJECT NAME: Building #3 Hydronic Boiler System Upgrades

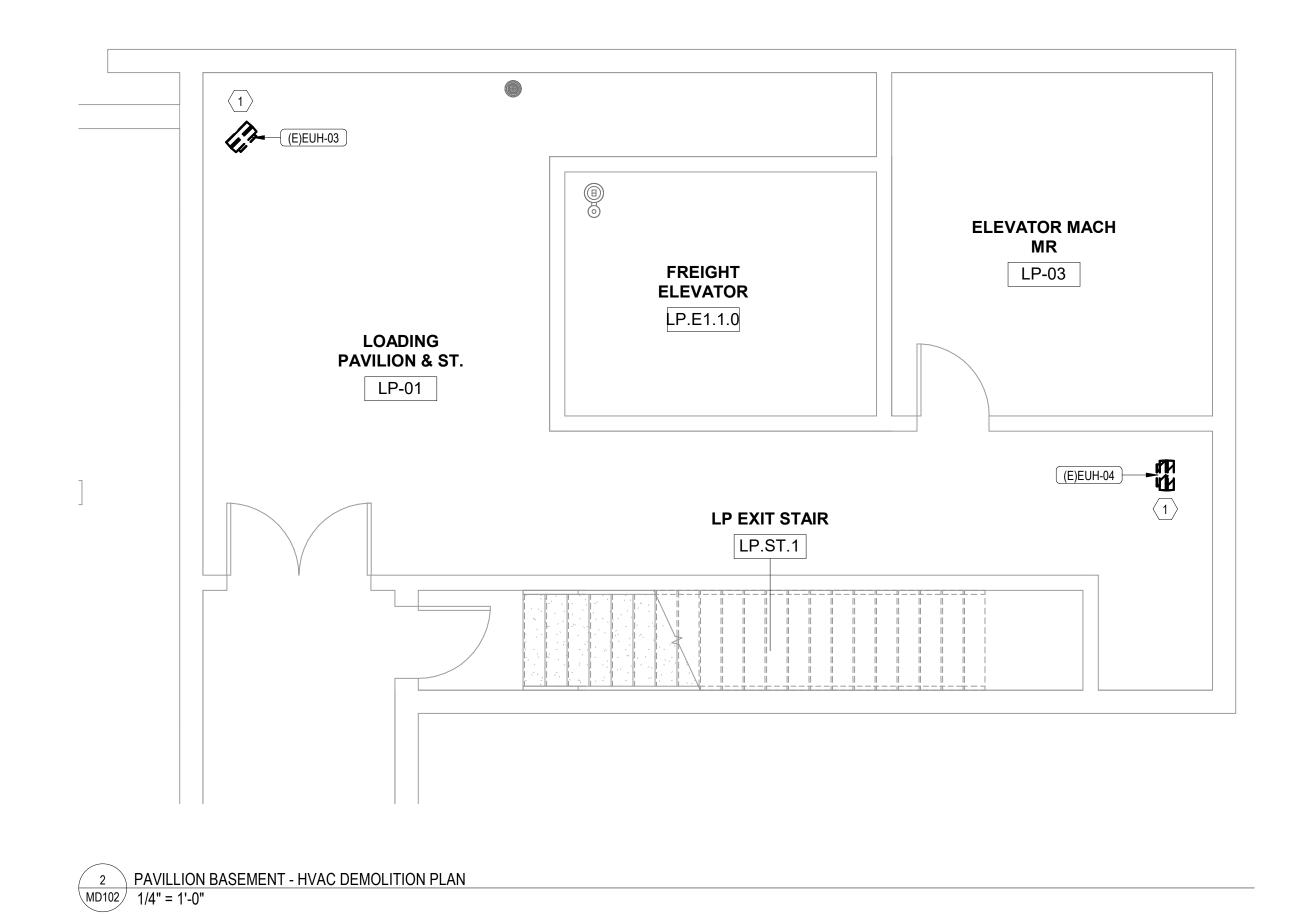
1900 Kanawha Boulevard East, Charleston, WV 25305

**BUILDING 3 BASEMENT** MECHANICAL ROOM DEMO

CHECKED BY:TZ3 DRAWING NO:



1 PAVILION FIRST FLOOR - HVAC DEMOLITION PLAN 1/4" = 1'-0"



## MECHANICAL DEMOLITION GENERAL NOTES

1 IF DURING CONSTRUCTION OF THIS PROJECT, WORK INVOLVING HAZARDOUS MATERIALS IS SUSPECTED OR ENCOUNTERED ALL WORK IN THIS AREA SHALL BE DISCONTINUED AND THE OWNER'S REPRESENTATIVE SHALL BE NOTIFIED IMMEDIATELY AND THE OWNER WITH HIS OWN FORCES OR BY SEPARATE CONTRACT SHALL BE RESPONSIBLE FOR COMPLETE INVESTIGATION, REMOVAL, AND DISPOSAL OF THE HAZARDOUS MATERIALS IN ACCORDANCE WITH APPLICABLE LAWS AND REGULATIONS. IF COSTS ARE INVOLVED BECAUSE OF SUCH ACTION BY THE OWNER: CONTRACTOR SHALL FILE CLAIM AS PROVIDED

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  INSTALLATION OF NEW WORK, RELOCATING EXISTING OR REMOVING
  EXISTING WORK, EQUIPMENT OR SYSTEMS.
   OWNER SHALL REMOVE EXISTING LOOSE FURNISHINGS SUCH AS DESKS.
- CHAIRS, TABLES, ETC., FOR INSTALLATION OF NEW WORK CONTRACTOR SHALL COORDINATE EXTENT OF REQUIRED WORK WITH OWNER. CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING AND SCHEDULING WITH THE OWNER A MINIMUM OF (3) DAYS IN ADVANCE OF WHEN THE FURNISHINGS NEED MOVED AND WILL NOT CONTACT THE OWNER ON MULTIPLE OCCASIONS DURING A SINGLE WORK DAY. CONTRACTOR SHALL BE RESPONSIBLE FOR RELOCATION AND REINSTALLATION OF ALL ELECTRICAL, PIPING, LIGHT SWITCHES, FIRE ALARM DEVICES, SPRINKLERS/FIRE PROTECTION, THERMOSTATS, ETC. AS REQUIRED FOR INSTALLATION OF NEW WORK. CONTRACTOR SHALL FIELD VERIFY THE LOCATION AND QUANTITIES OF ALL THE ITEMS TO BE RELOCATED AND/OR REMOVED AND SHALL BE INCLUDED IN THE BASE
- BID.

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- 9 PRIOR TO ANY DEMOLITION, THE GENERAL CONTRACTOR SHALL COORDINATE BRACING TO MAINTAIN THE STRUCTURAL INTEGRITY OF THE REMAINING ELEMENTS OF THE BUILDING AS REQUIRED.

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**KEYNOTES** 

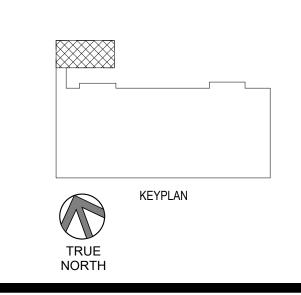
2 EXISTING SUSPENDED ELECTRIC UNIT HEATER TO REMAIN.

DEMO'D EXISTING SUSPENDED ELECTRIC UNIT HEATER TO BE TURNED OVER TO

Design/Consulting
Services

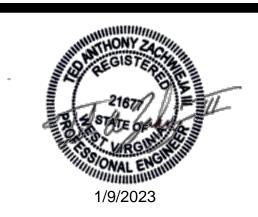
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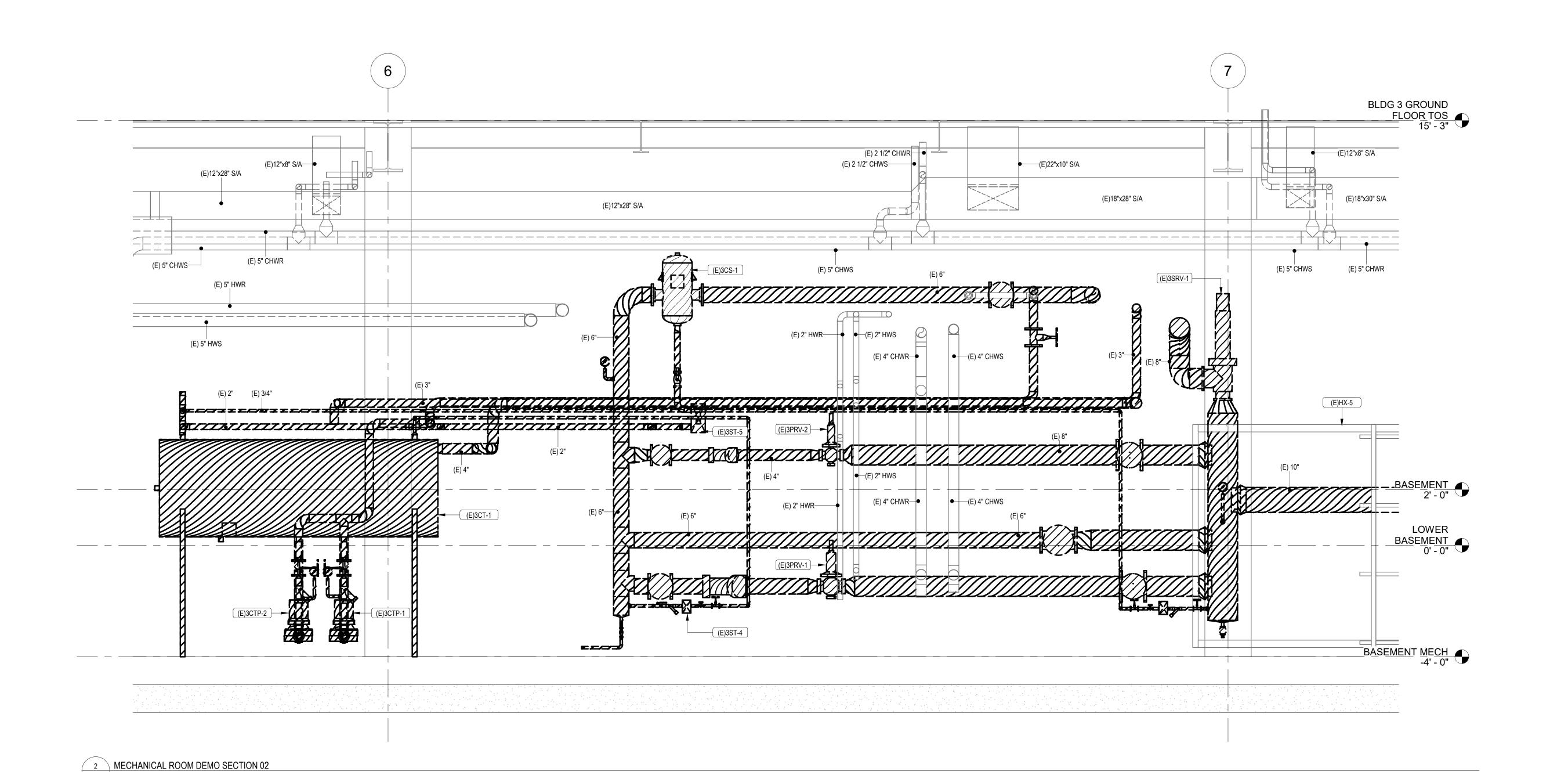
Building #3 Hydronic Boiler System Upgrades

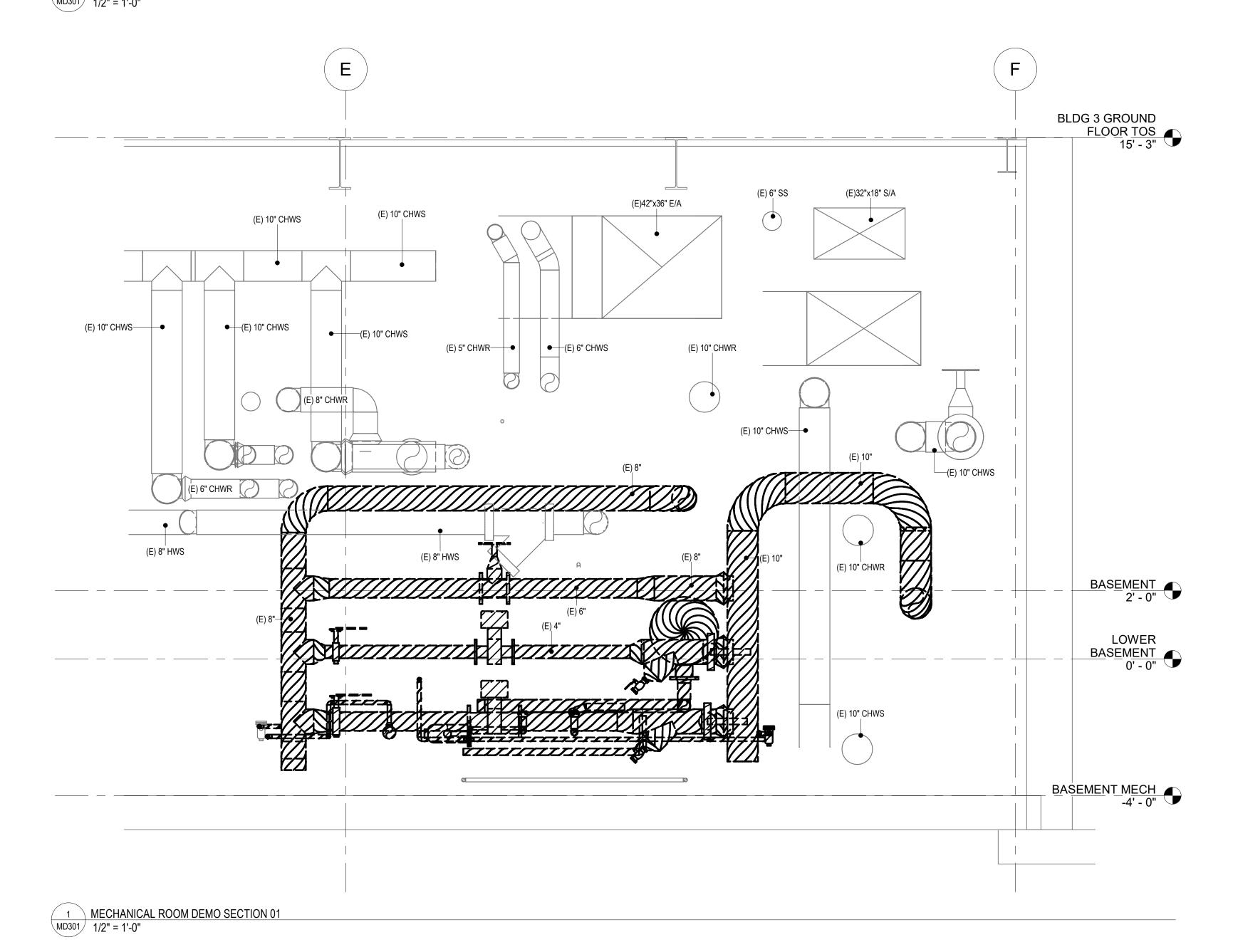
1900 Kanawha Boulevard East, Charleston, WV 25305

PAVILION HVAC DEMOLITION

FILE: XXX
DRAWN BY: ZDS
CHECKED BY:TZ3
PROJ. NO: GSD-221-C

**MD102** 





MECHANICAL DEMOLITION GENERAL NOTES

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- WHERE AREAS ARE EXPOSED DURING DEMOLITION WORK INCLUDING,
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  ADJACENT AREAS REMAIN IN OPERATION AS REQUIRED.

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THE REMAINING ELEMENTS OF THE BUILDING AS REQUIRED.

KEYNOTES

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Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

DRAWING TITLE:
MECHANICAL DEMO
SECTIONS

FILE: XXX

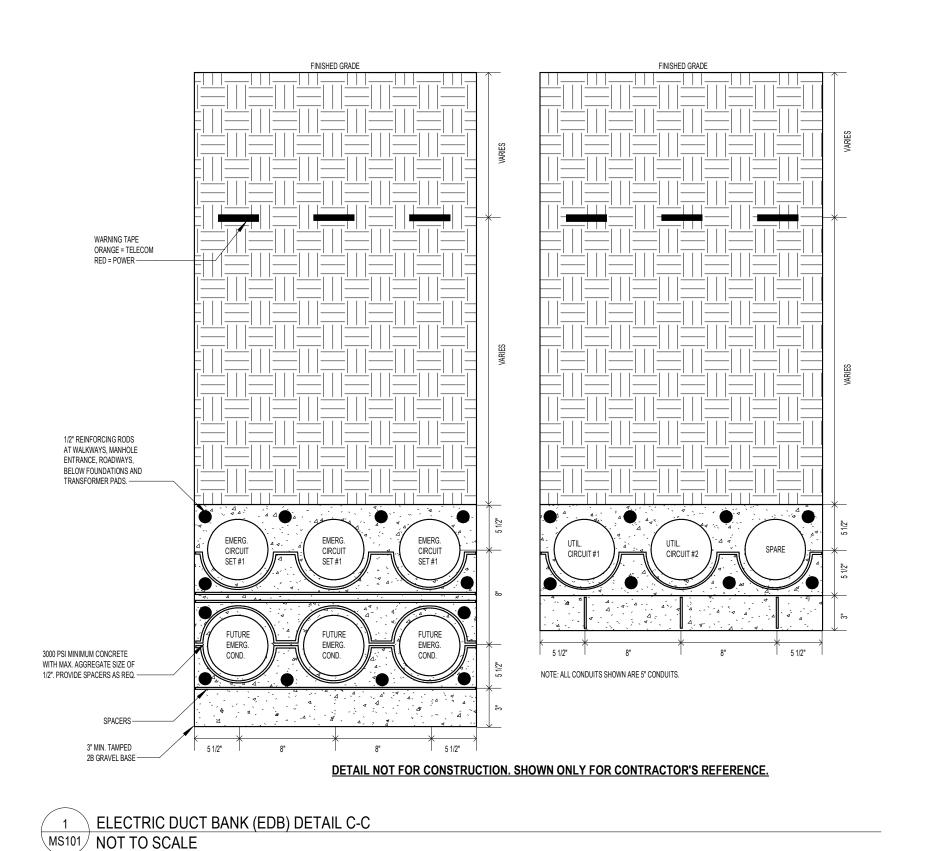
DRAWN BY: TZ3

CHECKED BY:TZ3

PROJ. NO: GSD-221

DRAWING NO:

/D301



# **KEYNOTES**

- CONTRACTOR SHALL CAP AND FINISH THE INSIDE WALL, PAINT THE WATER STAINS TO MATCH EXISTING. REFER TO PHOTOS ON MS102.
- DISCONNECT AND ABANDON 6" HPS AND 3" PCDR PIPE IN PLACE. 1-800-834-2070 MOUNTAINEER GAS CALL CENTER. VERIFY ANY ABANDONED GAS LINES ARE INACTIVE PRIOR TO DISTURBING IF ENCOUNTERED WHEN DIGGING. A GAS LINE PREVIOUSLY USED TO SERVE BUILDING #3 THAT WAS STEEL AND/OR PLASTIC MAY BE ENCOUNTERED AND CONTRACTORS SHALL EXERCISE EXTREME CARE TO ENSURE ITS INACTIVE. REFER TO SHEET M000 FOR ADDITIONAL
- 4 REFER TO ELECTRIC DUCT BANK DETAIL C-C FOR SECTION VIEW OF EXISTING ELECTRIC DUCT BANKS INSTALLATION AT THIS LOCATION.

- EXISTING 8" 30 PSIG SUMMER AND 60 PSIG WINTER MEDIUM PRESSURE GAS LINE
- INFORMATION.
- 6 CONTRACTOR SHALL USE EXTREME CARE WHILE WORKING AROUND ELECTRIC

DUCT BANKS.

# CONSTRUCTION DOCUMENTATION:

- 1. THE CONTRACTOR SHALL RECORD THE INSTALLATION OF THE
- WORK UTILIZING SURVEY EQUIPMENT. CONSTRUCTION DOCUMENTATION SHALL BE AN ITEM ON THE PRECONSTRUCTION MEETING AGENDA, TO REINTERATE THE
- 3. A POINT FILE SHALL BE GENERATED INDICATING THE INSTALLED WORK AND THE EXISTING APPURTANCES ENCOUNTERED DURING EXCAVATION. EACH POINT SHALL HAVE THREE COORDINATES (X,Y AND Z AND A DISTINCT LABEL FOR EACH POINT). I. TWO BENCH MARKS SHALL BE SET AND WILL BE CONSIDERED THE REFERENCE POINTS FOR THE WORK. THE CORNERS OF THE

SCOPE AND THE INTENT OF THE CONSTRUCTION DOCUMENTATION.

EXISTING BUILDING SHALL ALSO BE UTILIZED FOR THE REFERENCE POINT TO DOCUMENT THE INSTALLED WORK. ABOVE GROUND APPURTENANCES: ALL LUMINAIRES, SIGNS. WALKS, CONCRETE, ETC. ENCOUNTERED 10'-0" ON BOTH SIDES OF

THE OPEN TRENCH SHALL BE LOCATED AND SHALL BE PART OF

- THE POINT FILE. 6. UNDERGROUND APPURTENANCES: ALL PIPE, CONDUIT, CONCRETE, ETC. ENCOUNTERED DURING EXCAVATION SHALL BE INCLUDED WITHIN THE POINT FILE.
- 7. THE CONTRACTOR SHALL GENERATE A DRAWING BASED ON THE POINT FILE. THE DRAWING SHALL BE LABELED INDICATING ALL WORK INSTALLED. THE SAME DRAWING SHALL INDICATE THE EXISTING APPURTENANCES ENCOUNTERED DURING EXCAVATION THE APPROPRIATE POINTS SHALL BE CONNECTED WITH LINES TO
- INDICATE PIPES, EDGES OF MATERIALS, BUILDINGS, ETC. 8. THE DRAWINGS SHALL BE APROVED PRIOR TO INCLUDING THEM WITHIN THE CLOSING DOCUMENTS. 9. THE CONTRACTOR SHALL SUBMIT, AS PART OF THE CLOSING

## DOCUMENTS: A THUMB DRIVE AND HARD COPIES OF THE RECORD DRAWINGS. THE THUMB DRIVE SHALL HAVE THE POINT FILE, THE ELECTRONIC DRAWING FILES, AND THE PDFs MADE FROM THE ELECTRONIC DRAWINGS. SEE SPECIFICATIONS FOR THE NUMBER OF COPIES TO BE SUBMITTED.

## MH#3 TO BASEMENT OF BUILDING #5

- 6" HPS 3" PUMPED CONDENSATE CONTAINMENT PIPING FOR ALL
- BASEMENT OF BUILDING #5 TO MH #3 12" HPS 6" PUMPED CONDENSATE
- 2" HP-CDR CONTAINMENT PIPING FOR ALL

## **GENERAL NOTES**

- PRIOR TO BRINGING ANY HEAVY EQUIPMENT (TRUCKS, TRAILERS, LIFTS, ETC.) ON SITE THE CONTRACTOR SHALL DOCUMENT WITH PHOTOS/VIDEO ANY EXISTING DAMAGE THAT COULD BE CONSTRUED AS BEING CAUSED BY THE CONSTRUCTION ACTIVITIES. DAMAGED ELEMENTS INCLUDE, BUT ARE NOT LIMITED TO, SIDEWALKS, CURBS, DRIVEWAYS, PARKING LOTS AND GRASSY AREAS. DOCUMENTATION SHALL BE PROVIDED TO THE OWNER AND ENGINEER PRIOR TO STARTING WORK. ANY DAMAGE INCURRED DURING THE CONSTRUCTION PROCESS SHALL BE REPAIRED TO THE SATISFACTION OF THE OWNER AND ENGINEER. THIS INCLUDES, BUT IS
  - NOT LIMITED TO CONCRETE, ASPHALT, AND REGRADING/RESEEDING OF GRASSY AREAS. EXISTING SITE UTILITIES ARE SHOWN TO INDICATE GENERAL LOCATION AND MAY NOT SHOW ALL EXISTING SITE UTILITIES. FIELD VERIFY LOCATION AND DEPTH OF ALL EXISTING SITE
- THRUST BLOCKS, EXPANSION JOINTS, FITTINGS AND ALL OTHER ACCESSORIES RECOMMENDED BY THE UNDERGROUND PIPE MANUFACTURER MAY NOT BE SHOWN.
- COORDINATE ALL REQUIREMENTS WITH THE PIPING MANUFACTURER. THESE DRAWINGS ARE BASED UPON HISTORICAL DRAWINGS OF THE EXISTING BUILDING AND FIELD VERIFICATION OF PORTIONS OF THE WORK.
- NOT ALL DETAILS AND REQUIREMENTS ARE SHOWN IN ONE LOCATION. REFER TO ISOMETRICS FLOW DIAGRAMS, DETAILS, ENLARGED PLANS, SPECIFICATIONS, AND FLOOR PLANS FOR ADDITIONAL INFORMATION.
- THE CONTRACTOR SHALL FIELD VERIFY THE LOCATION OF THE EXISTING BURIED STEAM AND CONDENSATE PIPING. THE CONTRACTOR SHALL BE RESPONSIBLE TO LOCATE AND IDENTIFY ALL OTHER BURIED UTILITIES THAT MAY BE IN THE AREA TO BE EXCAVATED. CONTRACTOR SHALL REPORT ANY DISCREPANCIES IN THE EXISTING SITE UTILITY INFORMATION TO THE
- PIPE SUPPORTS, EXPANSION PADS AND MOMENT GUIDES FOR THE HEATING HOT WATER PIPING SHALL BE INSTALLED TO ACCOMMODATE THERMAL EXPANSION PER PIPE
- MANUFACTURER'S RECOMMENDATION. CONTRACTOR SHALL USE EXTREME CARE IF WORKING NEAR EXISTING SITE UTILITIES. ALL THE NEW SITE PIPING INSTALLED UNDER THIS PROJECT SHALL BE SURVEYED BY A LAND SURVEYOR LICENSED IN WEST VIRGINIA. THE SURVEY SHALL BE FURNISHED ON A THUMB

DRIVE IN AUTOCAD ".DWG" FORMAT AND PDF FORMAT.

- CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES DURING CONSTRUCTION. EXISTING UTILITIES WHICH ARE NOT TO BE REMOVED OR ABANDONED SHALL REMAIN OPERATIONAL AT ALL TIMES. ANY DAMAGED DEVICES SHALL BE REPAIRED OR REPLACED AT THE END OF EACH WORK DAY BEFORE LEAVING THE SITE.
- SHOULD EXISTING CONDITIONS IN THE FIELD NECESSITATE CONSTRUCTION METHODS OR MEANS OTHER THAN THOSE SHOWN OR SPECIFIED, THE CONTRACTOR SHALL NOTIFY THE ENGINEER TO OBTAIN APPROVAL PRIOR TO PROCEEDING WITH CONSTRUCTION.
- ALL DISTURBED AREAS SHALL BE RESTORED TO THE ORIGINAL CONDITION OR BETTER. EXCAVATION, BACKFILL, AND RESTORATION REQUIRED FOR ALL NEW DIRECT BURIED PIPE. THE CONTRACTOR SHALL FOLLOW SAME-DAY STABILIZATION PRACTICES FOR ALL UTILITY INSTALLATION. ONLY THE AMOUNT OF TRENCH THAT CAN BE OPENED, WORKED IN, AND THEN STABILIZED IN A WORK DAY SHALL BE PERFORMED. IF STABILIZATION DOES NOT OCCUR AT THE END OF THE WORK DAY, THEN APPROPRIATE EROSION CONTROLS, SEDIMENT CONTROLS
- AND SAFETY CONTROLS SHALL BE INSTALLED. ANY DAMAGE OUTSIDE SCOPE OF WORK INCLUDING THE CONSTRUCTION ACCESS SHALL BE CORRECTED AT THE CONTRACTOR'S EXPENSE. METAL PLATES MAY BE UTILIZED TO PROTECT
- SURROUNDING FACILITIES ARE TO REMAIN IN OPERATION DURING CONSTRUCTION. ALL WORK SHALL BE CONDUCTED SO AS TO MINIMIZE DISRUPTION TO THOSE FACILITIES. THE CONTRACTOR SHALL MAINTAIN TRAFFIC AT ALL TIMES. PEDESTRIAN THRUWAY TRAFFIC AND ACCESS TO ALL BUILDINGS IS TO BE MAINTAINED AT ALL TIMES. THE CONTRACTOR SHALL PROVIDE THE APPROPRIATE PROTECTIONS INCLUDING PEDESTRIAN SAFETY AND DIRECTIONAL
- SIGNS DURING ALL PHASES OF WORK. SURFACED STREETS AND PARKING AREAS SHALL BE MAINTAINED IN A CLEAN CONDITION, MUD AND DUST FREE AT ALL TIMES. ADEQUATE MEANS SHALL BE PROVIDED TO CLEAN TRUCKS AND EQUIPMENT. ALL TOOLS AND EQUIPMENT SHALL BE STORED WITHIN THE CONTRACTOR'S
- 3 EXISTING CONCRETE SIDEWALKS SHALL BE SAWCUT PRIOR TO REMOVAL. ALL SAWCUTS SHALL BE STRAIGHT, EVEN CUTS. JAGGED EDGES SHALL NOT BE PERMITTED. THE CONTRACTOR SHALL MAINTAIN A 2' MINIMUM COVER OVER STEAM, CONDENSATE PIPING AND ALL UTILITIES DURING CONSTRUCTION, ALL WORK SHALL BE PERFORMED IN A NEAT.
- ALL PIPE SHALL BE CLEANED BEFORE THEY ARE LAID AND SHALL BE KEPT CLEAN UNTIL ACCEPTANCE OF THE COMPLETED WORK BY THE OWNER. OPEN ENDS PIPES SHALL BE FITTED WITH WATER TIGHT STOPPERS TO PREVENT ENTRANCE OF FOREIGN MATTER WHEN

PROFESSIONAL AND SAFE MANNER AND SHALL COMPLY WITH ALL LOCAL, STATE AND FEDERAL

- PIPE-LAYING OPERATIONS ARE INTERRUPTED. UNCLASSIFIED EXCAVATION: EXCAVATION IS UNCLASSIFIED TO SUBGRADE ELEVATIONS REGARDLESS OF THE CHARACTER OF SURFACE AND SUBSURFACE CONDITIONS ENCOUNTERED, INCLUDING ROCK, SOIL MATERIALS, AND OBSTRUCTIONS. IF EXCAVATED MATERIALS INTENDED FOR FILL AND BACKFILL INCLUDE UNSATISFACTORY SOIL MATERIALS AND ROCK, REPLACE WITH SATISFACTORY MATERIALS.
- FIELD VERIFY LOCATION AND INVERTS OF SITE UTILITIES PRIOR TO INSTALLATION. COORDINATE ALL UNDERGROUND PIPING WITH ALL OTHER TRADES INCLUDING ELECTRICAL DUCT BANKS, ELECTRICAL SERVICE CONDUITS, WATER AND GAS SERVICE PIPING. CONTRACTOR IS RESPONSIBLE FOR LOCATION AND COORDINATION OF ALL APPLICABLE BELOW AND ABOVE GROUND UTILITIES, PIPING AND EQUIPMENT. CONTRACTOR SHALL
- PRIOR TO ANY CONSTRUCTION. NEW AND EXISTING ABOVE AND UNDERGROUND UTILITIES, PIPING AND EQUIPMENT SHALL BE PROTECTED ALL THE TIMES. ALL BUILDING PENETRATIONS SHALL BE FLASHED AND SEALED PER THE SPECIFICATION
- REQUIREMENTS. CONTRACTOR SHALL COORDINATE EGRESS REQUIREMENTS WITH OWNER WHEN CONSTRUCTION ACTIVITIES IMPACT USING THE BUILDING EGRESS AS REQUIRED TO MEET WA

CONTACT SITE UTILITY LOCATOR SERVICE TO OBTAIN ALL UNDERGROUND UTILITY LOCATIONS

STATE FIRE MARSHALL REQUIREMENTS. 26 CONTRACTOR SHALL FURNISH AND INSTALL A SPARE PULL-SPRING AT EACH CONDUIT INSTALLED AND/OR UTILIZED.

CD – CURB INLET

FHP - FIRE HYDRANT

YH) – YARD HYDRANT

W - WATER MANHOLE

√WM − WATER METER

WV – WATER VALVE T - TELEPHONE PEDESTAL

CB - STORM CATCH BASIN

HB – SPIGOT/ HOSE BIB

TRAFFIC SIGNAL

SANITARY SEWER CLEANOUT

CA - CABLE TELEVISION JUNCTION BOX

CTV – CABLE TELEVISION PEDESTAL

TB - TRAFFIC SIGNAL CONTROL BOX DS - ROOF DOWNSPOUT

CO – STORM SEWER CLEANOUT

CB - STORM CATCH BASIN

CULVERT

GM - GAS METER

GV − GAS VALVE

HPS - HIGH PRESSURE STEAM

LPS - LOW PRESSURE STEAM

PC - PUMPED CONDENSATE

HPC - HIGH PRESSURE CONDENSATE

LPC - LOW PRESSURE CONDENSATE

D - STORM SEWER MANHOLE

FIRE CONNECTION-SIAMESE

X - PIPE ANCHOR

✓ XX PHOTO LOCATION - REFER TO DRAWING M108 & M109

UU − UNKNOWN UTILITY PAINT MARK

EDB - ELECTRIC DUCT BANK

E – ELECTRIC LINE PAINT MARK TELEPHONE LINE PAINT MARK

WATERLINE PAINT MARK

CABLE TELEVISION LINE PAINT MARK

SANITARY SEWER LINE PAINT MARK

- FIBER-OPTIC LINE PAINT MARK

- LIGHT POLE w/SINGLE FIXTURE

LIGHT POLE w/DOUBLE FIXTURE

- GAS LINE PAINT MARK

- UTILITY POLE

🌣 – LIGHT POST DI DI – DROP INLET

FLOOD LIGHT

C – CABLE TELEVISION MANHOLE

E – ELECTRIC MANHOLE

EM - ELECTRIC METER

ELECTRICAL WEATHER HEAD

ELECTRIC TRANSFORMER

F - FIBER-OPTIC MANHOLE

TELEPHONE MANHOLE

S – SANITARY VALVE VAULT

SANITARY SEWER MANHOLE

EB - ELECTRIC BOX (HANDHOLE, PULL BOX

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PROJECT NAME: Building #3 Hydronic Boiler System Upgrades

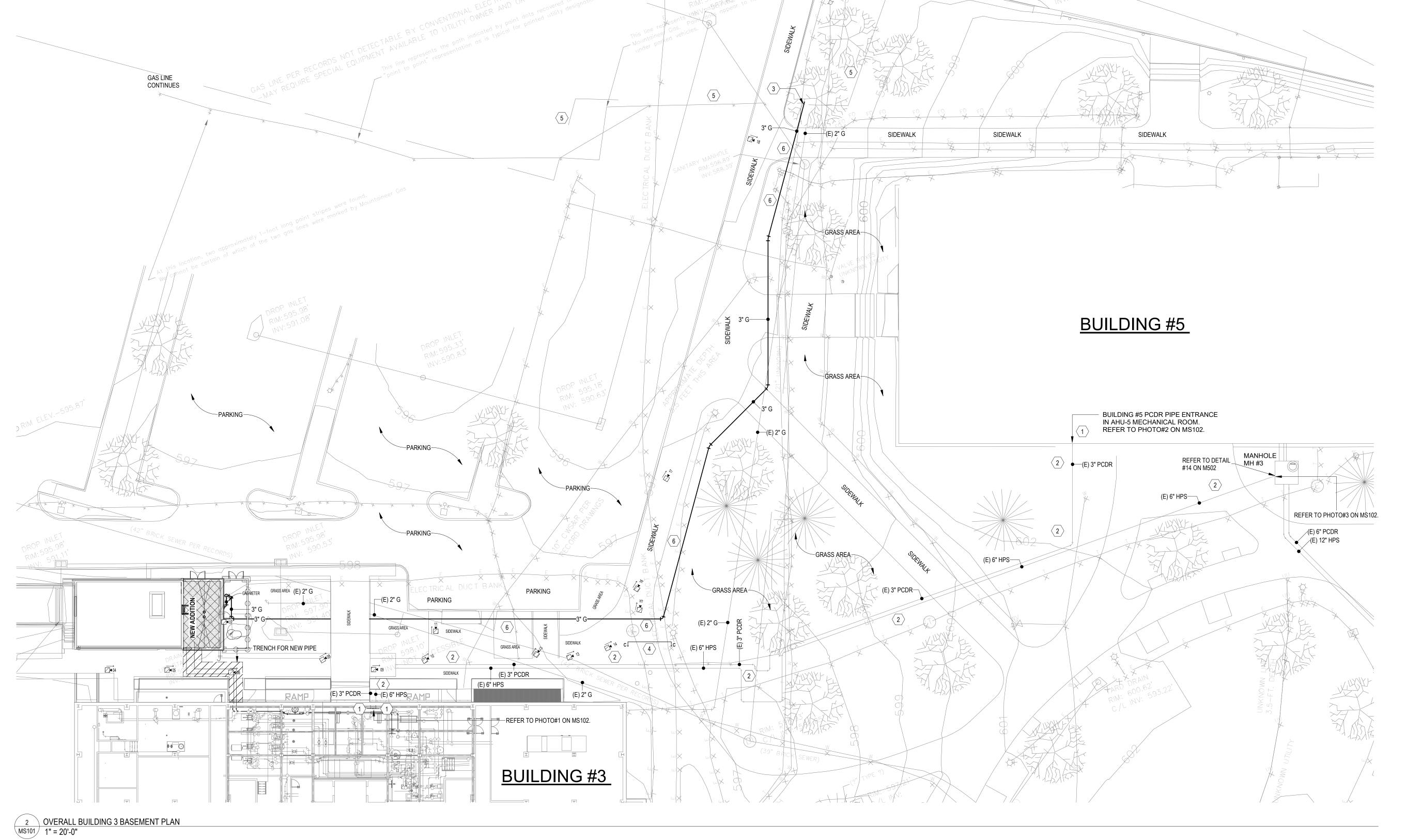
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DRAWING TITLE: MECHANICAL SITE PLAN

DRAWN BY: TZ3 CHECKED BY:TZ3

PROJ. NO: GSD-221-C

DRAWING NO:

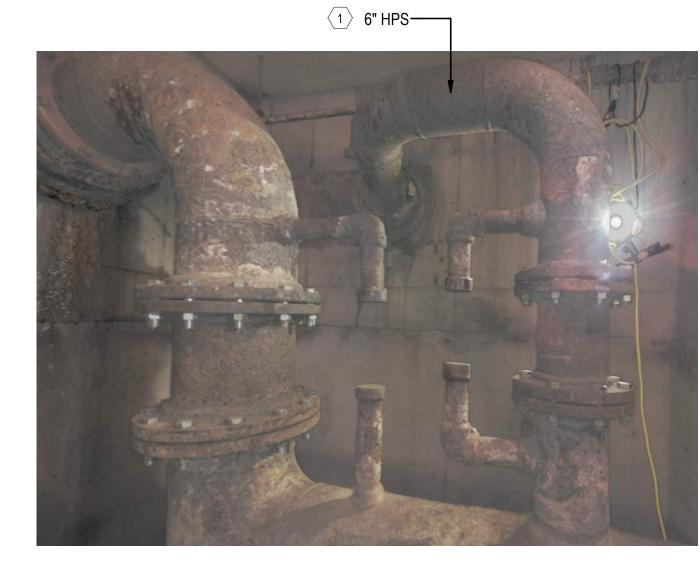








2 BUILDING #5 PCDR PIPE ENTRANCE/EXIT AT EXTERIOR WALL IN AHU-5 MECHANICAL ROOM - PHOTO#2 NOT TO SCALE



MH#3 - 6" HPS PIPE TO BUILDING #3 - PHOTO#3
NOT TO SCALE

## GENERAL DEMOLITION NOTES:

- 1. DO NOT CUT PAVERS. DO NOT CUT GRANITE SLABS. REMOVE EACH SECTION IN
- DO NOT CUT PAVERS. DO NOT CUT GRANITE SLABS. REMOVE EACH SECTION IN ONE PIECE.
   STORE PAVERS AND GRANITE SLABS SAFELY FOR REINSTALLATION.
   CUT CONCRETE AT CONTROL JOINTS OR CUT CONCRETE AT EXPANSION JOINTS. DO NOT CUT CONCRETE BETWEEN JOINTS, UNLESS APPROVED BY OWNER/ENGINEER. SEE DETAILS FOR REINSTALLATION.
   THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT EXTENT OF PAVER, GRANITE AND CONCRETE REMOVAL TO INSURE A SAFE OPEN TRENCH FOR PERSONNEL
- 5. THE CONTRACTOR SHALL MAINTAIN THE SITE IN A SAFE CONDITION FOR PERSONNEL
- AND FOR VISITORS.

  6. IF THE CONTRACTOR ENCOUNTERS A UTILITY, NOTIFY THE OWNER AND ENGINEER IMMEDIATELY. THE CONTRACTOR SHALL AID THE OWNER AND ENGINEER TO IDENTIFY THE UTILITY. THE UTILITY SHALL BE IDENTIFIED AND INCORPORATED WITHIN THE CONSTRUCTION DOCUMENTATION TO BE SUBMITTED AT THE END OF THE

## **KEYNOTES**

- CONTRACTOR SHALL CAP AND FINISH THE INSIDE WALL. PAINT THE WATER STAINS
- TO MATCH EXISTING. EXCAVATE AS REQUIRED FOR INSTALLATION OF NEW GAS LINE. RESTORE BACK TO ORIGINAL CONDITION.



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4 PHOTO # 04
MS102 NOT TO SCALE



5 PHOTO # 05 MS102 NOT TO SCALE



6 PHOTO # 06 MS102 NOT TO SCALE



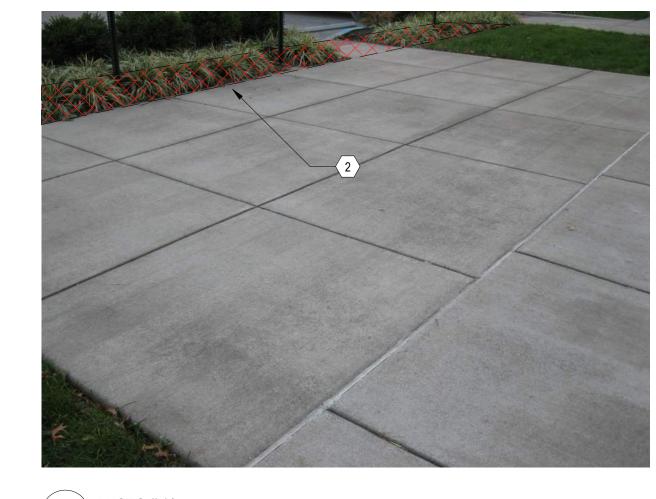
7 PHOTO # 07 MS102 NOT TO SCALE



8 PHOTO # 08 MS102 NOT TO SCALE



9 PHOTO # 09 MS102 NOT TO SCALE



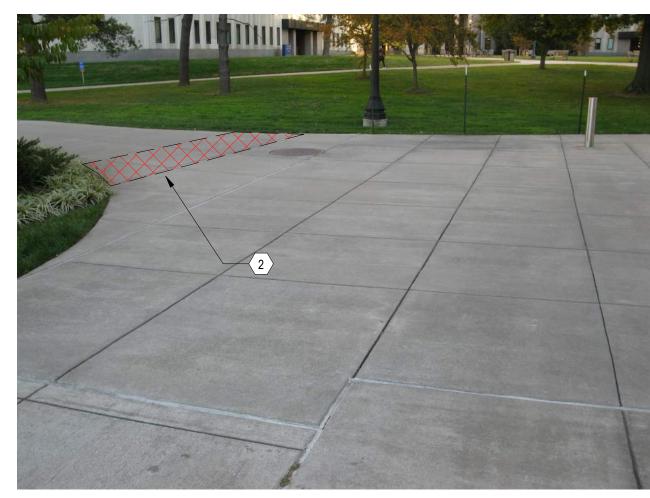
10 PHOTO # 10 NOT TO SCALE



11 PHOTO # 11 NOT TO SCALE

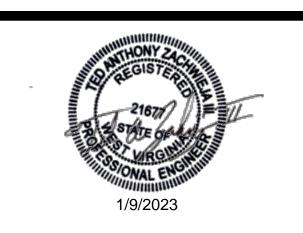


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DRAWING TITLE:







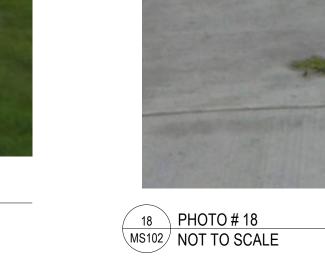
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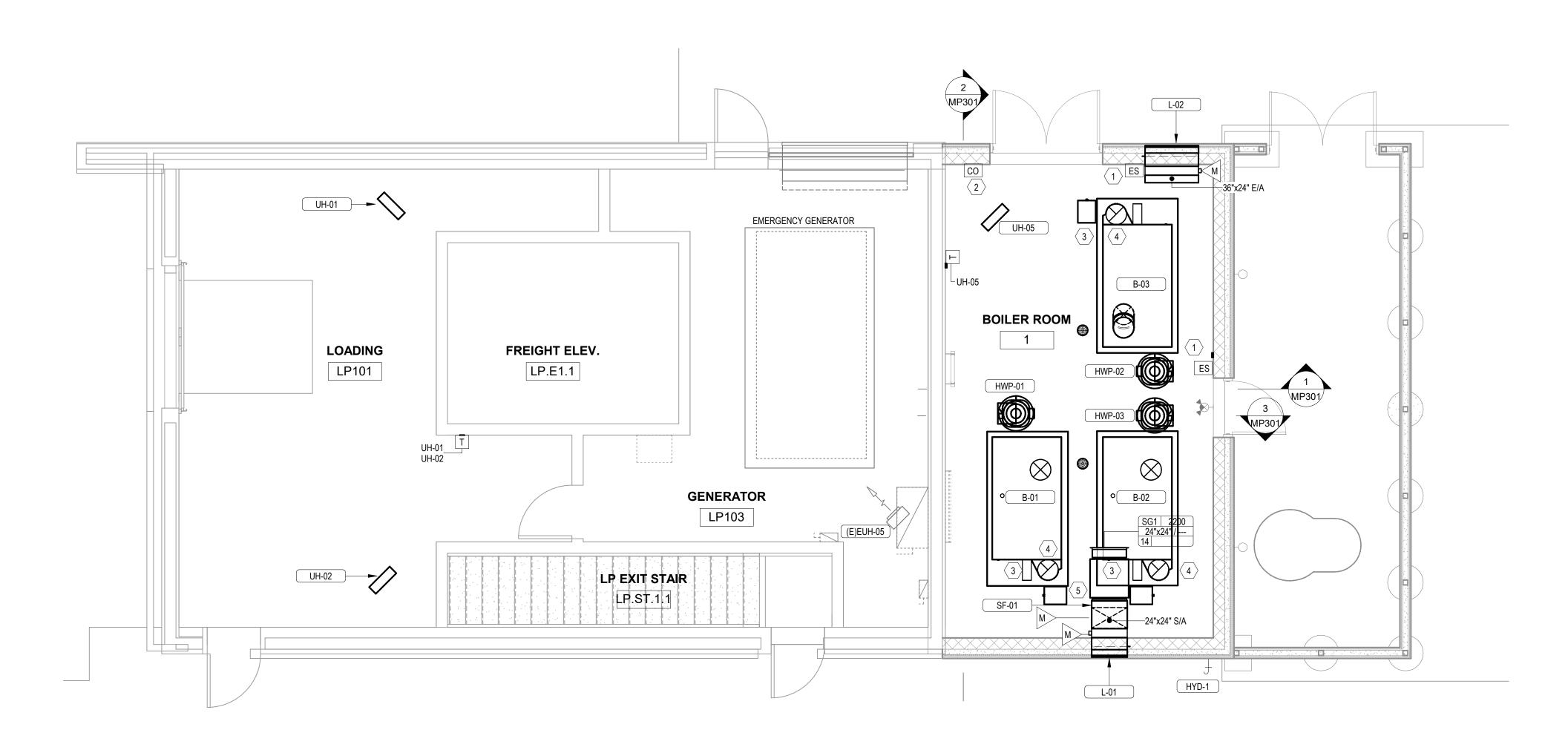


16 PHOTO # 16 NOT TO SCALE



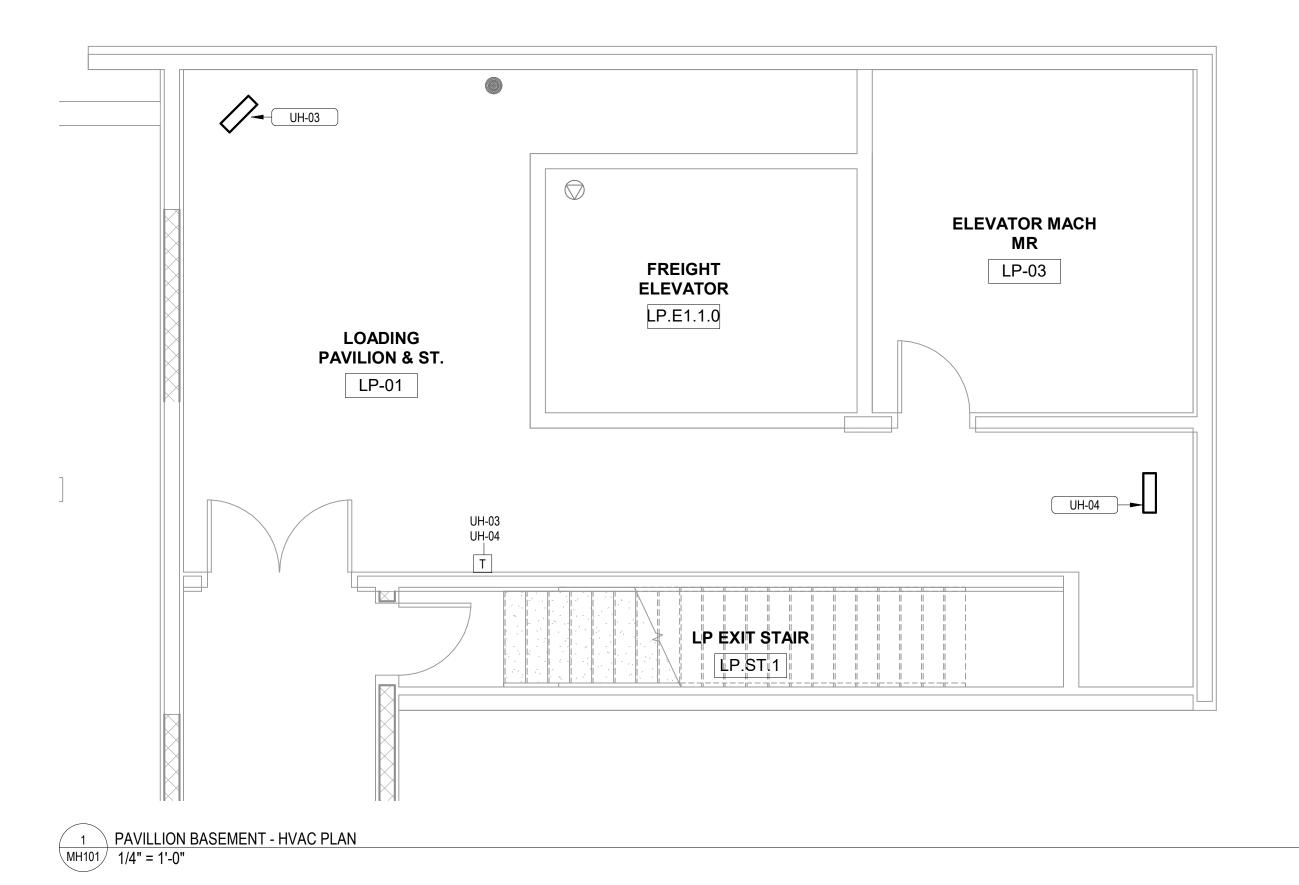
17 PHOTO # 17 MS102 NOT TO SCALE





PAVILION FIRST FLOOR - HVAC PLAN

1/4" = 1'-0"



## GENERAL NOTES - NEW CONSTRUCTION

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- NO CONCENTRIC REDUCERS WILL BE USED IN HORIZONTAL PIPING. ALL ECCENTRIC REDUCERS
- SHALL BE INSTALLED FLAT SIDE DOWN. 4 FOR 2" AND SMALLER PIPING PROVIDE UNIONS AT VALVES, STRAINERS, FINAL EQUIPMENT CONNECTIONS AND ELSEWHERE INDICATED.
- FOR 2 1/2" AND LARGER PIPING PROVIDE FLANGED VALVES, STRAINERS, FINAL EQUIPMENT CONNECTIONS AND ELSEWHERE INDICATED.
- 6 CONTRACTOR SHALL FURNISH AND INSTALL INSULATION ON ALL NEW PIPING, FITTINGS, VALVES AND EQUIPMENT UNLESS OTHERWISE RECOMMENDED BY THE EQUIPMENT MANUFACTURER. CONTRACTOR SHALL INCLUDE ADDITIONAL INSULATION IN THE BASE BID PROPOSAL, BEYOND WHAT IS INDICATED AND NOTED IN THE BID DOCUMENTS, AS FOLLOWS: •PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) ON EXISTING PIPE AND FITTINGS AT POINTS OF NEW PIPE CONNECTIONS; •WHERE NEW VALVES AND FITTINGS ARE SHOWN INSTALLED IN EXISTING PIPING SYSTEMS, PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) OF INSULATION ON EITHER SIDE OF THE COMPONENTS FOR THE EXISTING PIPE AND FITTINGS;
- •ALLOW FOR AN ADDITIONAL 100 LF OF INSULATION FOR EXISTING PIPE AND FITTING IN SIZES UP TO 8" NPS TO BE APPLIED WHERE MISSING/DAMAGED INSULATION IS ENCOUNTERED AND AS DIRECTED BY THE OWNER/ENGINEER. •REFER TO SPECIFICATIONS SECTION FOR DETAILS ON THE INSULATION REQUIREMENTS. ALL COSTS FOR COMPLETE FURNISHING AND INSTALLING THE ADDITIONAL INSULATION DESCRIBED HERE SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID PROPOSAL.

## **KEYNOTES**

PROVIDE EMERGENCY BOILER SHUTOFF. REFER TO DETAIL FOR ADDITIONAL INFORMATION. PROVIDE ALL VALVES, DEVICES, WIRING, AND ACCESSORIES FOR A COMPLETE AND OPERATIONAL SYSTEM.

- CONTROLS CONTRACTOR SHALL FURNISH AND INSTALL BLUE STROBE/HORN EQUAL TO KELE MODEL 869STR-B-AQ (24V) SHALL BE BY CONTROLS CONTRACTOR. ALSO, PROVIDE TEST AND ACKNOWLEDGE BUTTON FOR MANUAL TESTING OF ALARM DEVICE LOCATED IN THE ROOM. LOCATE HORN/STROBE IN ROOM OR IN THE ADJACENT ROOM IN LOCATION APPROVED BY THE OWNER/ ENGINEER. PROVIDE SIGNAGE TO LABEL STROBE/HORN "CARBON MONOXIDE ALARM". CONFIRM SIZE/COLOR OF LETTERING WITH OWNER.
- CONTRACTOR SHALL PROVIDE 304 STAINLESS STEEL CONDENSATE PIPING AND ACID NEUTRALIZING TANK AS RECOMMENDED BY THE BOILER MANUFACTURER AS REQUIRED. TANK SHALL BE FILLED WITH MEDIA AS RECOMMENDED BY MANUFACTURER. RUN COPPER CONDENSATE DRAIN PIPING TO NEAREST FLOOR
- FIELD INSTALL STACK TEMPERATURE SENSOR WIRED TO THE BOILER CONTROL PANEL LIMIT SWITCH TO SHUTDOWN BOILER IF TEMPERATURE REACHES 185°F (ADJUSTABLE). LOCATE SENSOR NEAR OUTLET OF BOILER. INSTALL NEW BOILER COMBUSTION EXHAUST AND MAKEUP AIR VENT TERMINATION THROUGH ROOF OPENING. PRIOR TO FLUE PIPING INSTALLATION THE CONTRACTOR SHALL FIELD VERIFY THE OPENING PROVIDES A STRAIGHT CLEAR PATHWAY THROUGH THE ROOF. PROVIDE A BOILER FLUE TERMINATION KIT AT THE TOP OF THE OPENING TO COMPLY WITH INTERNATIONAL FUEL AND GAS CODE AS WELL AS THE MANUFACTURER'S WRITTEN INSTRUCTIONS. FLASH AND SEAL ALL VENT PENETRATIONS AS REQUIRED. EXHAUST FLUE MUST BE UL LISTED, CATEGORY IV APPROVED STAINLESS STEEL SEALED VENT MATERIAL. INCLUDE ALL ACCESSORIES, FITTINGS AND PIPE FOR A COMPLETE AND OPERATIONAL SYSTEM. CONTRACTOR SHALL PROVIDE FABRICATION DRAWINGS TO ENGINEER FOR FINAL APPROVAL PRIOR TO ORDERING.
- FURNISH AND INSTALL 2" FIBERGLASS BOARD INSULATION ON OUTDOOR DUCT, RETURN DUCT, AND SUPPLY DUCT ASSOCIATED WITH SF-1. REFER TO SPECIFICATIONS FOR ADDITONAL INFORMATION.

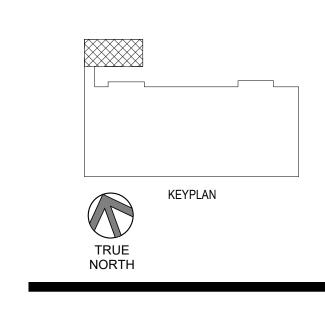
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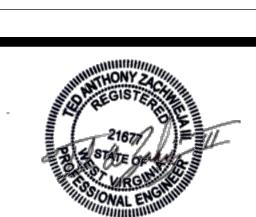
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PROJECT NAME:
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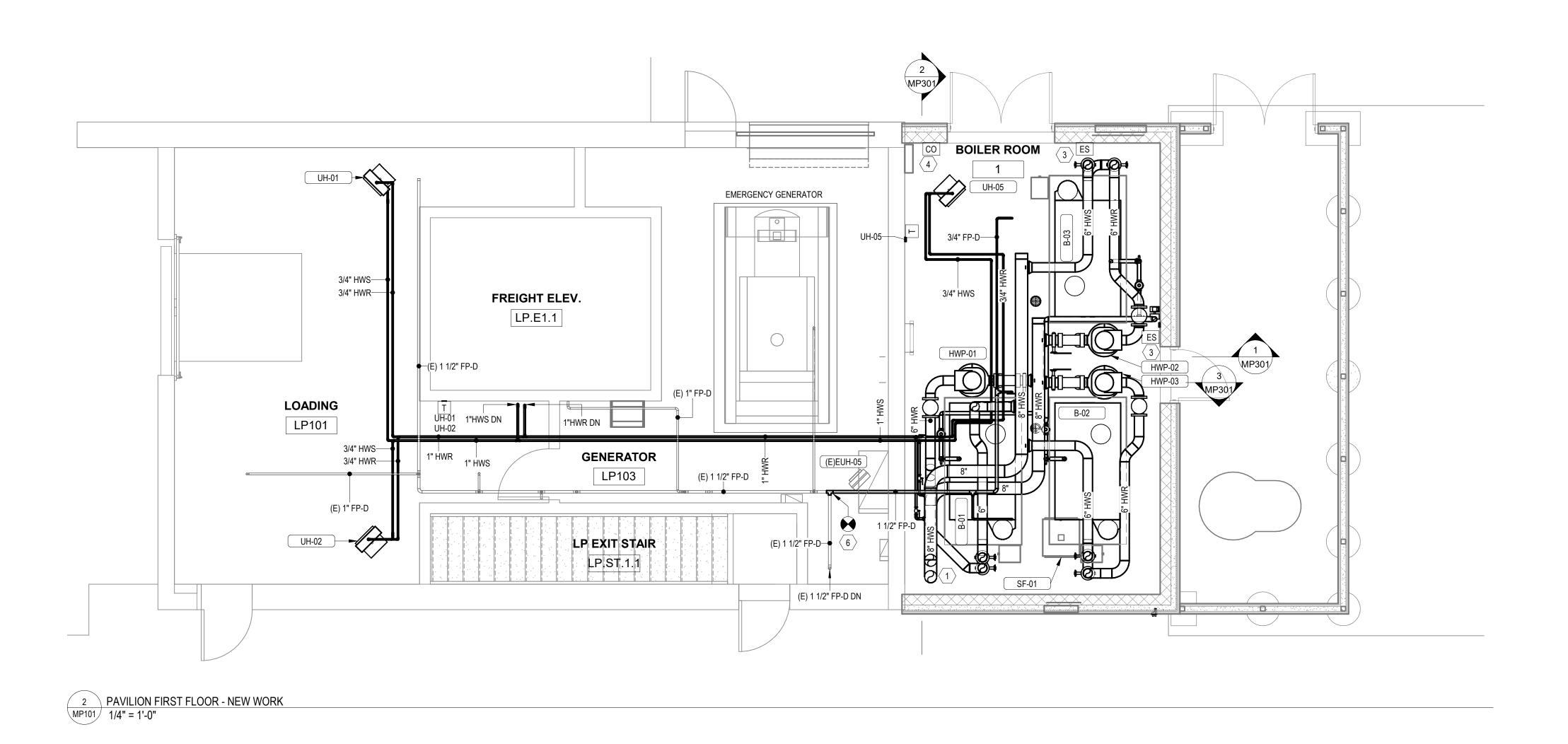
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**BUILDING 3 BASEMENT** ENLARGED HVAC PLAN -**NEW WORK** 

DRAWN BY: TZ3 CHECKED BY:VB

DRAWING NO:

**MH101** 



# GENERAL NOTE - FIRE PROTECTION

THE ORIGINAL FIRE PROTECTION CONTRACTOR IS BREWER & COMPANY OF WV, INC. CONTACT PERSON DOUG MEEKS (304)744-5314 WHO CAN ASSIST IN PROVIDING COSTS FOR PROPOSED SPRINKLER MODIFICATIONS.

## GENERAL NOTES - NEW CONSTRUCTION

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- FOR 2 1/2" AND LARGER PIPING PROVIDE FLANGED VALVES, STRAINERS, FINAL EQUIPMENT CONNECTIONS AND ELSEWHERE INDICATED.
- CONTRACTOR SHALL FURNISH AND INSTALL INSULATION ON ALL NEW PIPING, FITTINGS, VALVES AND EQUIPMENT UNLESS OTHERWISE RECOMMENDED BY THE EQUIPMENT MANUFACTURER. CONTRACTOR SHALL INCLUDE ADDITIONAL INSULATION IN THE BASE BID PROPOSAL, BEYOND WHAT IS INDICATED AND NOTED IN THE BID DOCUMENTS, AS FOLLOWS: •PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) ON EXISTING PIPE AND FITTINGS AT POINTS OF NEW PIPE CONNECTIONS;
- •WHERE NEW VALVES AND FITTINGS ARE SHOWN INSTALLED IN EXISTING PIPING SYSTEMS, PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) OF INSULATION ON EITHER SIDE OF THE COMPONENTS FOR THE EXISTING PIPE AND FITTINGS; •ALLOW FOR AN ADDITIONAL 100 LF OF INSULATION FOR EXISTING PIPE AND FITTING IN SIZES UP TO 8" NPS TO BE APPLIED WHERE MISSING/DAMAGED INSULATION IS ENCOUNTERED AND AS DIRECTED BY THE OWNER/ENGINEER.

•REFER TO SPECIFICATIONS SECTION FOR DETAILS ON THE INSULATION REQUIREMENTS. ALL COSTS FOR COMPLETE FURNISHING AND INSTALLING THE ADDITIONAL INSULATION DESCRIBED HERE SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID PROPOSAL.

## **KEYNOTES**

- HWS/R UNDER GROUND TO BUILDING 3. REFER TO OTHER DRAWINGS FOR
- CONTINUATION. CONTRACTOR SHALL PROVIDE EPRO WATERPROOFING SYSTEM OR EQUAL ON THE EXTERIOR WALL FOR STEAM AND CONDENSATE PIPE PENETRATION TO MAKE THEM WATER TIGHT. REFER TO DETAIL FOR LINK SEAL AND FOR WATER PROOFING OF EXTERIOR. EXTEND THE WATERPROOFING MATERIAL FOR A MINIMUM OF 2 FEET FROM OUTSIDE EDGE OF THE PIPING OR AS RECOMMENED BY WATERPROOFING SYSTEM MFR. MAINTAIN A MINIMUM OF 3" BETWEEN OD OF PIPES AS REQUIRED BY MFR.
- PROVIDE EMERGENCY BOILER SHUTOFF. REFER TO DETAIL FOR ADDITIONAL INFORMATION. PROVIDE ALL VALVES, DEVICES, WIRING, AND ACCESSORIES FOR A COMPLETE AND OPERATIONAL SYSTEM.
- CONTROLS CONTRACTOR SHALL FURNISH AND INSTALL BLUE STROBE/HORN EQUAL TO KELE MODEL 869STR-B-AQ (24V) SHALL BE BY CONTROLS CONTRACTOR. ALSO, PROVIDE TEST AND ACKNOWLEDGE BUTTON FOR MANUAL TESTING OF ALARM DEVICE LOCATED IN THE ROOM. LOCATE HORN/STROBE IN ROOM OR IN THE ADJACENT ROOM IN LOCATION APPROVED BY THE OWNER/ ENGINEER. PROVIDE SIGNAGE TO LABEL STROBE/HORN "CARBON MONOXIDE ALARM". CONFIRM SIZE/COLOR OF LETTERING WITH OWNER.
- REFER TO CONTROL SPECIFICATIONS FOR HOT WATER SYSTEM MAKE UP WATER METER TO BE INSTALLED IN EXISTING PIPING. TAP INTO EXISTING DRY SPRINKLER LINE AS REQUIRED FOR NEW ADDITION TO MEET WVSFM REQUIREMENTS. PROVIDE QUANTITY OF SPRINKLER HEADS AS REQUIRED AND COORDINTATED FOR THIS INSTALLATION. REFER TO M000 FOR

ADDITIONAL FIRE PROTECTION NOTES.

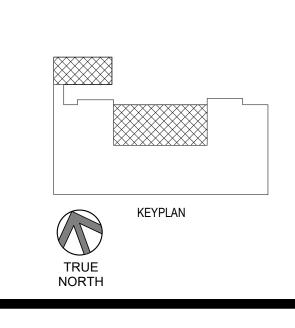
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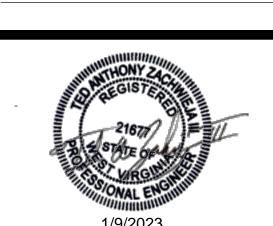
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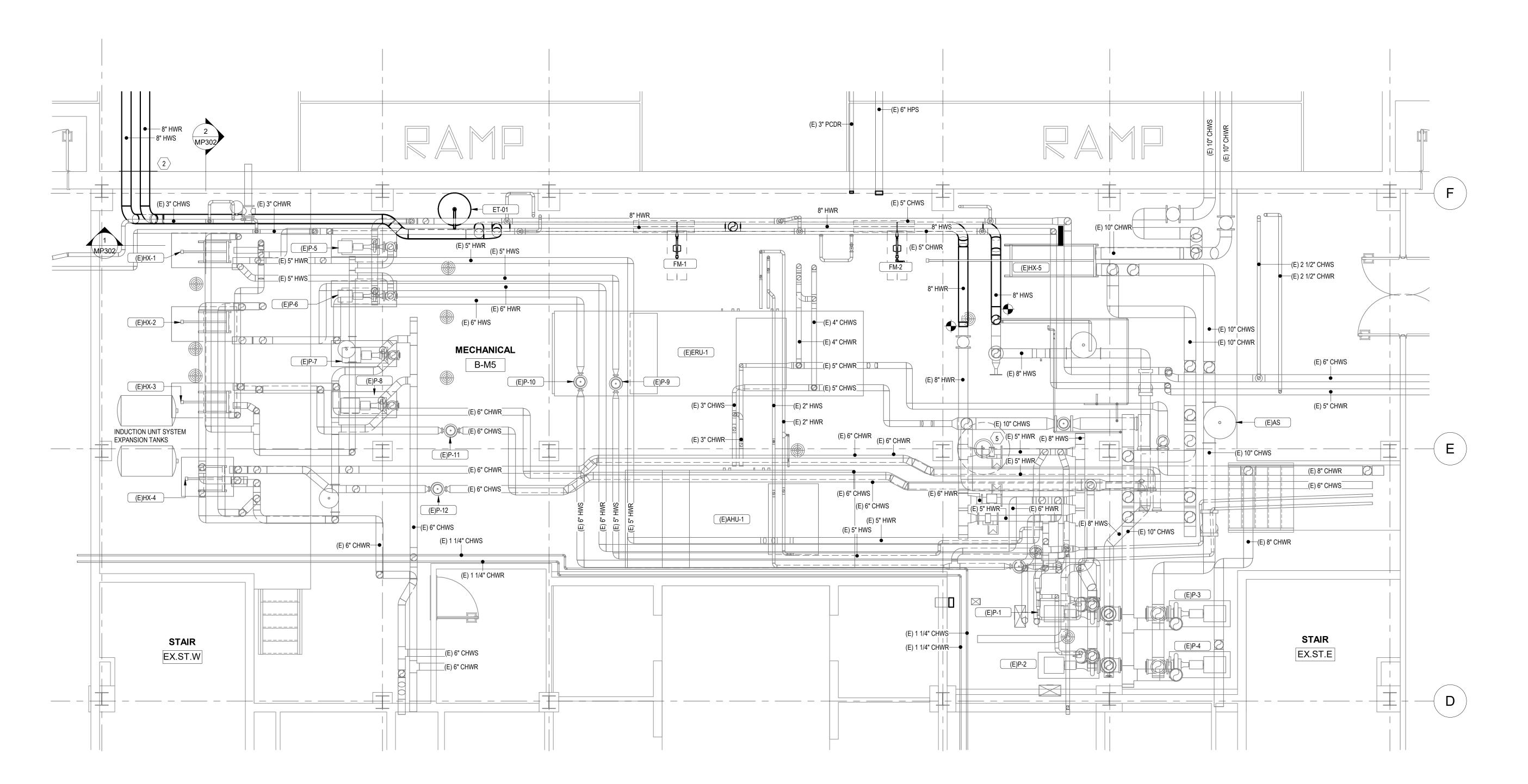
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PROJECT NAME: Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

**BUILDING 3 BASEMENT** ENLARGED PIPING PLAN - NEW WORK

DRAWING NO:



# **KEYNOTES**

- HWS/R PIPE FROM BOILER ROOM FROM FLOOR ABOVE. HWS/R PIPE ROUTE BELOW GRADE AND PENETRATE MECHANICAL ROOM WALL.
  - EXISTING DRY SPRINKLER LINE CONTINUES TO SPRINKLERS IN LOADING DOCK BASEMENT LEVEL.

# GENERAL NOTE - FIRE PROTECTION

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## GENERAL NOTES - NEW CONSTRUCTION

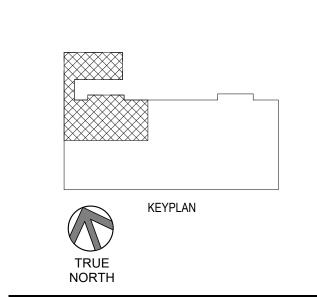
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- FOR 2" AND SMALLER PIPING PROVIDE UNIONS AT VALVES, STRAINERS, FINAL EQUIPMENT CONNECTIONS AND ELSEWHERE INDICATED. FOR 2 1/2" AND LARGER PIPING PROVIDE FLANGED VALVES, STRAINERS, FINAL EQUIPMENT
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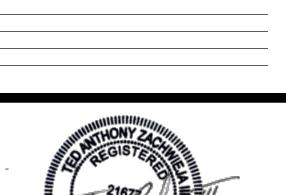
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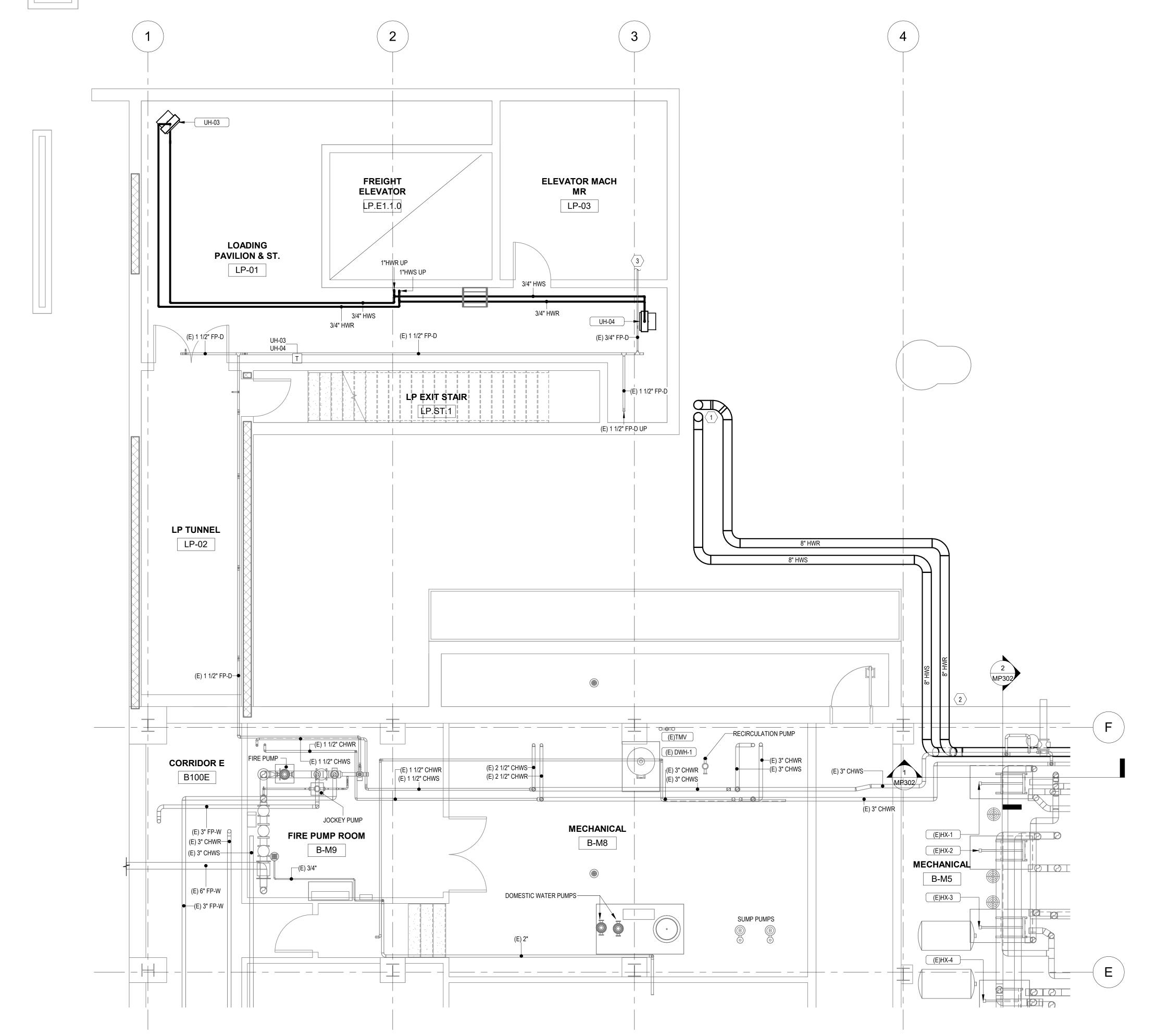


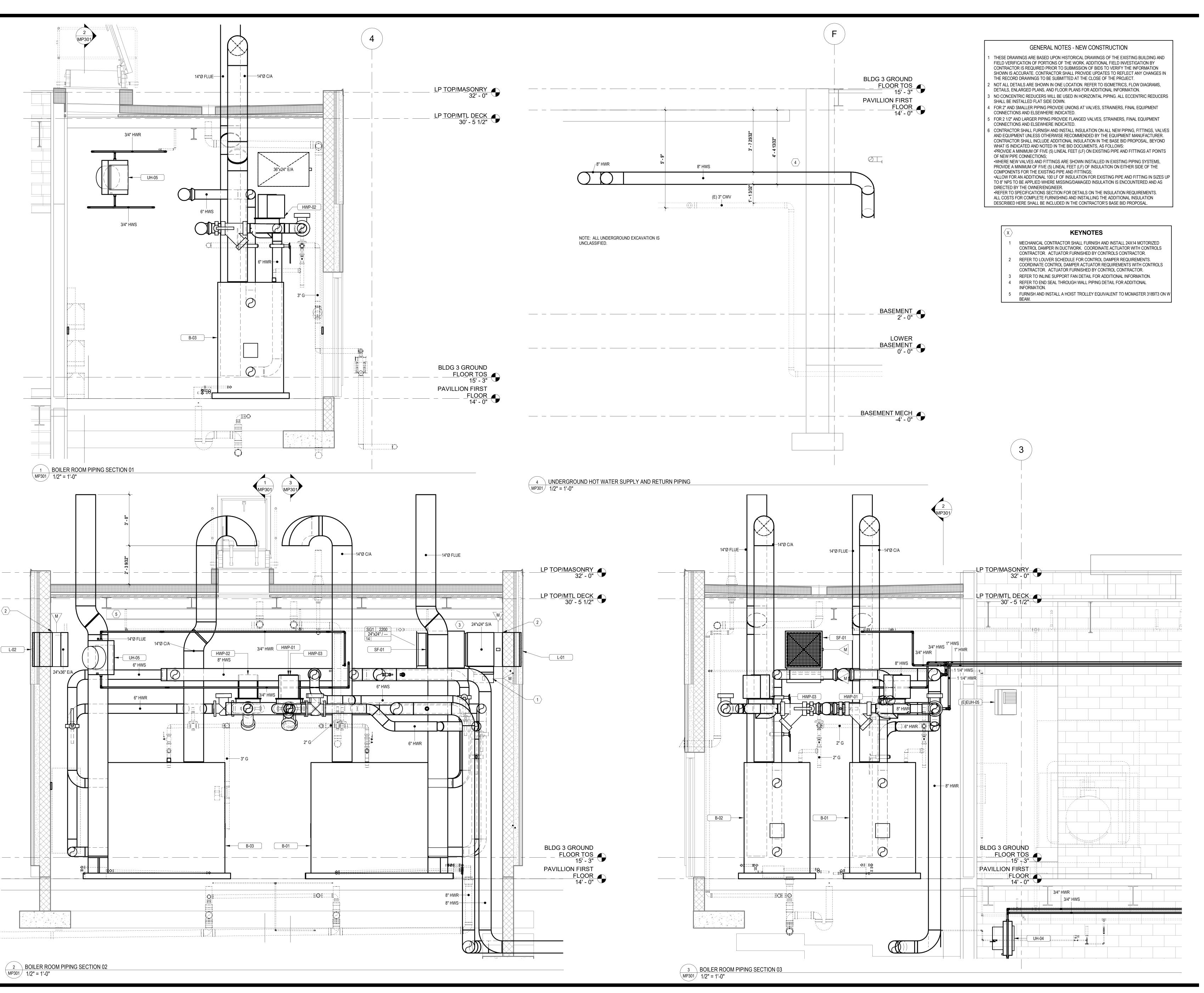
Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

**BUILDING 3 BASEMENT ENLARGED PIPING PLAN** - NEW WORK

DRAWN BY: VB CHECKED BY:TZ3 **MP102** PROJ. NO: GSD-221-C DRAWING NO:





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Building #3 Hydronic Boiler System Upgrades

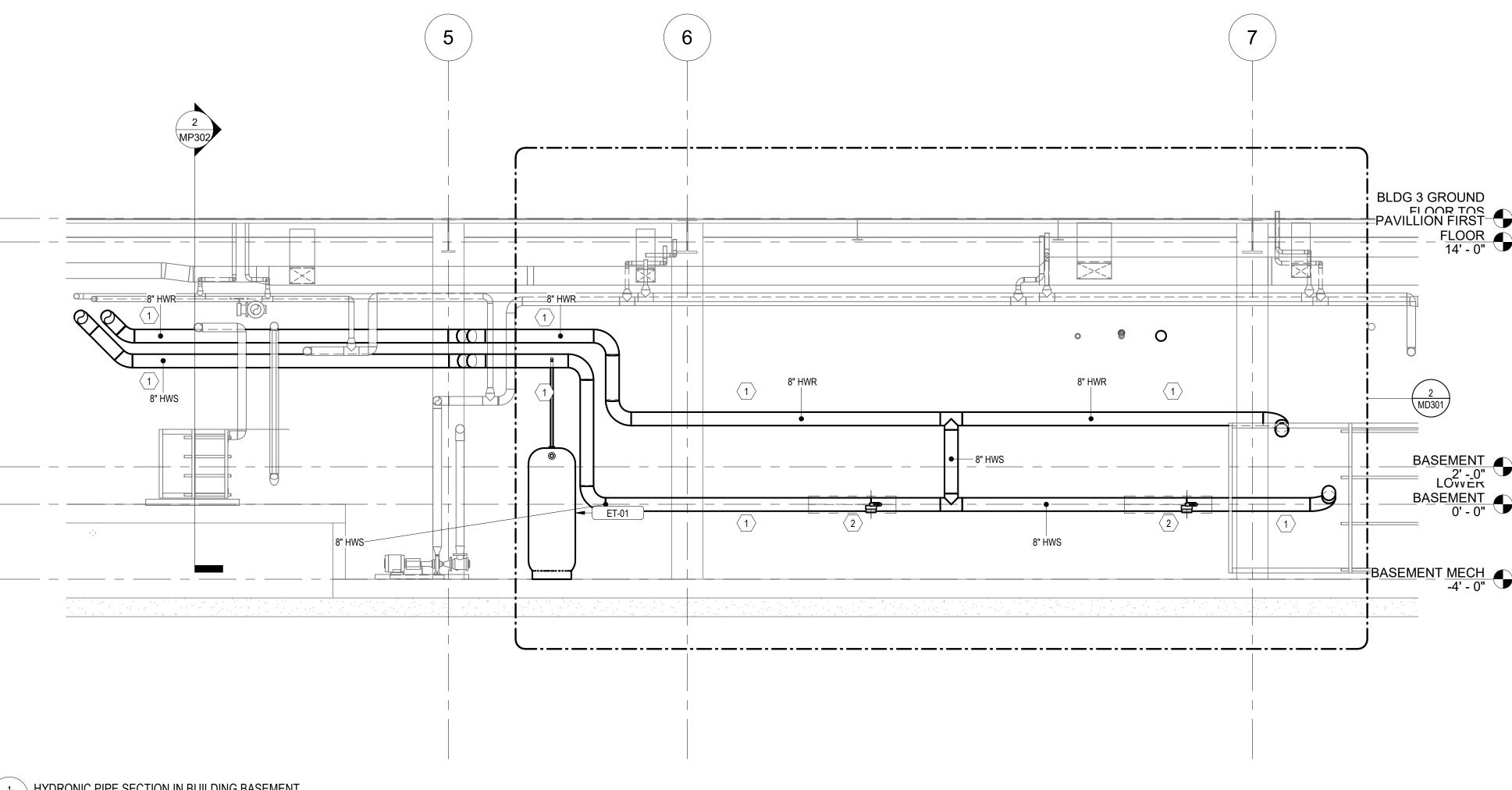
1900 Kanawha Boulevard East, Charleston, WV 25305

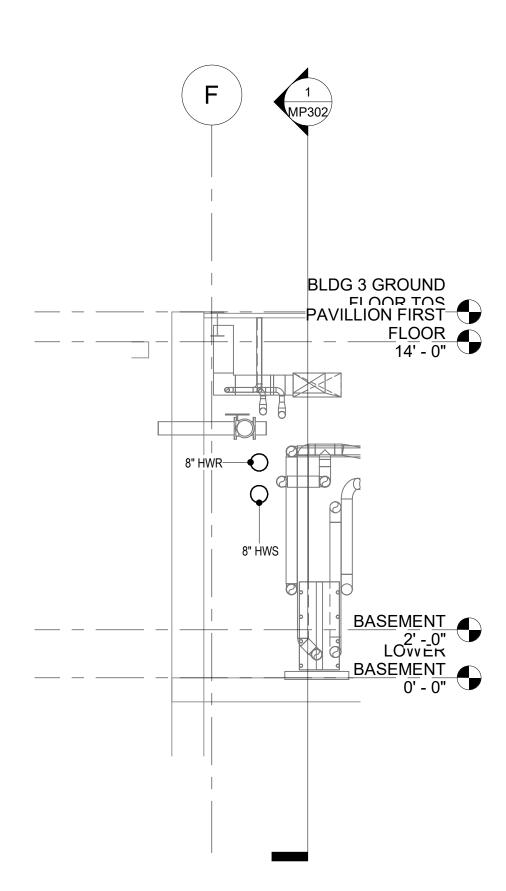
DRAWING TITLE: MECHANICAL PIPING SECTIONS

DRAWN BY: TZ3 CHECKED BY:TZ3 PROJ. NO: GSD-221-C

DRAWING NO:

**MP301** 







## GENERAL NOTES - NEW CONSTRUCTION

- THESE DRAWINGS ARE BASED UPON HISTORICAL DRAWINGS OF THE EXISTING BUILDING AND FIELD VERIFICATION OF PORTIONS OF THE WORK. ADDITIONAL FIELD INVESTIGATION BY CONTRACTOR IS REQUIRED PRIOR TO SUBMISSION OF BIDS TO VERIFY THE INFORMATION SHOWN IS ACCURATE. CONTRACTOR SHALL PROVIDE UPDATES TO REFLECT ANY CHANGES IN
- THE RECORD DRAWINGS TO BE SUBMITTED AT THE CLOSE OF THE PROJECT. 2 NOT ALL DETAILS ARE SHOWN IN ONE LOCATION. REFER TO ISOMETRICS, FLOW DIAGRAMS, DETAILS, ENLARGED PLANS, AND FLOOR PLANS FOR ADDITIONAL INFORMATION.
- NO CONCENTRIC REDUCERS WILL BE USED IN HORIZONTAL PIPING. ALL ECCENTRIC REDUCERS SHALL BE INSTALLED FLAT SIDE DOWN. FOR 2" AND SMALLER PIPING PROVIDE UNIONS AT VALVES, STRAINERS, FINAL EQUIPMENT
- CONNECTIONS AND ELSEWHERE INDICATED. 5 FOR 2 1/2" AND LARGER PIPING PROVIDE FLANGED VALVES, STRAINERS, FINAL EQUIPMENT
- CONNECTIONS AND ELSEWHERE INDICATED. CONTRACTOR SHALL FURNISH AND INSTALL INSULATION ON ALL NEW PIPING, FITTINGS, VALVES
- AND EQUIPMENT UNLESS OTHERWISE RECOMMENDED BY THE EQUIPMENT MANUFACTURER. CONTRACTOR SHALL INCLUDE ADDITIONAL INSULATION IN THE BASE BID PROPOSAL, BEYOND WHAT IS INDICATED AND NOTED IN THE BID DOCUMENTS, AS FOLLOWS: •PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) ON EXISTING PIPE AND FITTINGS AT POINTS OF NEW PIPE CONNECTIONS;
- •WHERE NEW VALVES AND FITTINGS ARE SHOWN INSTALLED IN EXISTING PIPING SYSTEMS, PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) OF INSULATION ON EITHER SIDE OF THE COMPONENTS FOR THE EXISTING PIPE AND FITTINGS;
- •ALLOW FOR AN ADDITIONAL 100 LF OF INSULATION FOR EXISTING PIPE AND FITTING IN SIZES UP TO 8" NPS TO BE APPLIED WHERE MISSING/DAMAGED INSULATION IS ENCOUNTERED AND AS DIRECTED BY THE OWNER/ENGINEER. •REFER TO SPECIFICATIONS SECTION FOR DETAILS ON THE INSULATION REQUIREMENTS. ALL COSTS FOR COMPLETE FURNISHING AND INSTALLING THE ADDITIONAL INSULATION DESCRIBED HERE SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID PROPOSAL.

## **KEYNOTES**

- FURNISH STRUCTURAL SHOP FABRICATION DRAWINGS FOR REVIEW OF FLOOR MOUNTED PIPE SUPPORTS. PIPES SHALL BE FLOOR SUPPORTED AT A MINIMUM OF 6 SUPPORTS WITH A MAXIMUM OF 12' BETWEEN SUPPORTS AND AT EACH CHANGE IN DIRECTION. PAINT STRUCTURAL STEEL PIPE SUPPORTS PER SPECIFICATIONS.
- INSTALL FLOW METER WITH MINIMUM STRAIGHT RUNS IN ACCORDANCE WITH MFR REQUIREMENTS.

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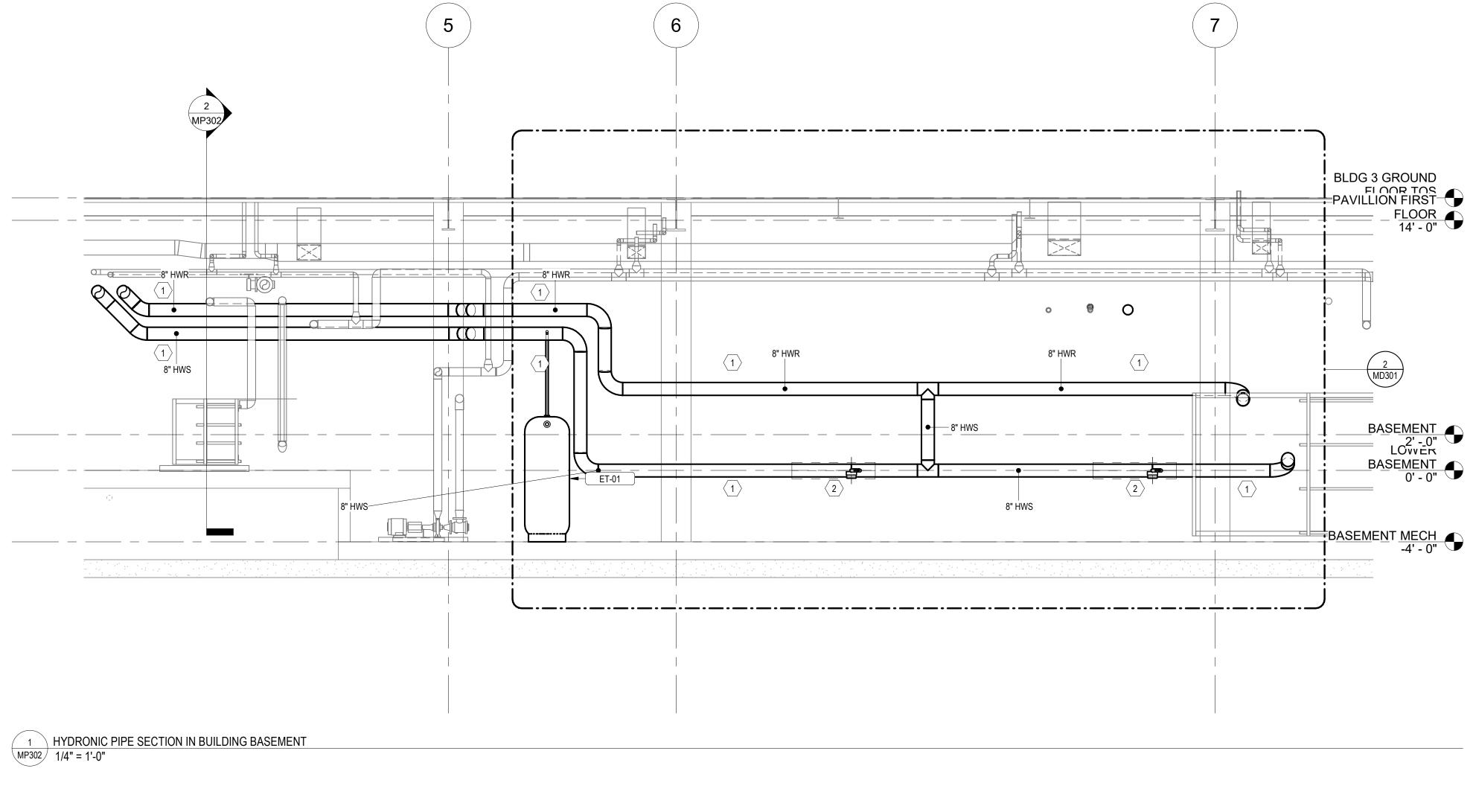
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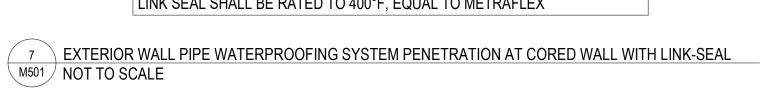
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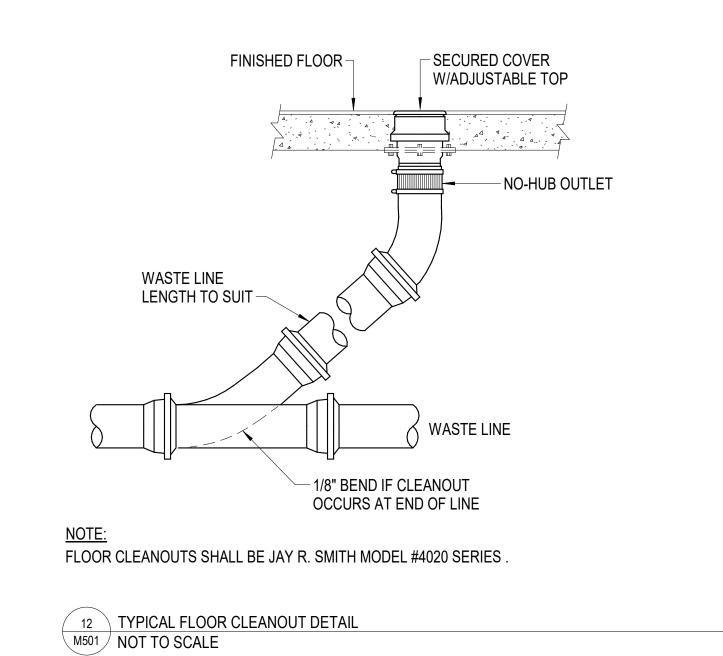
MECHANICAL PIPING SECTIONS

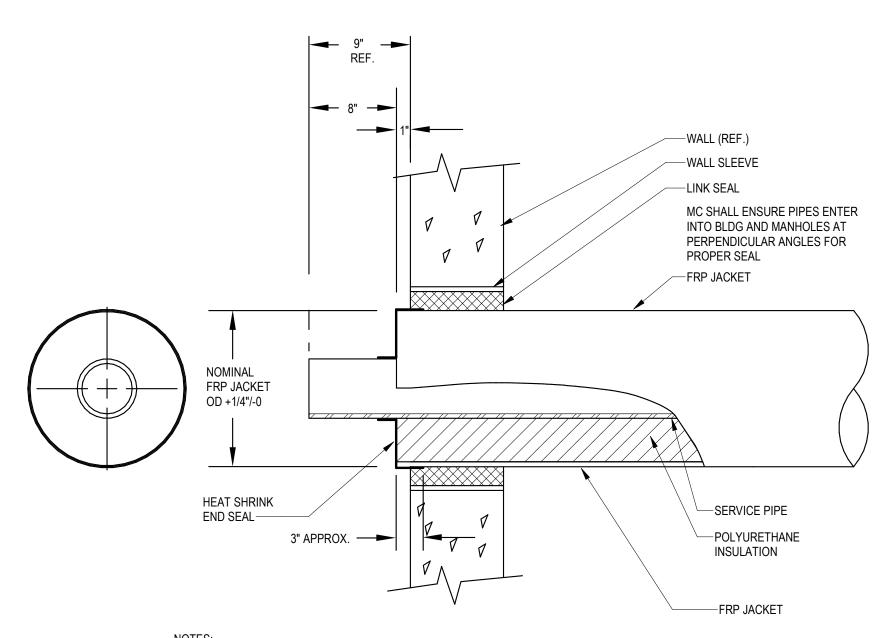
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**MP302** 





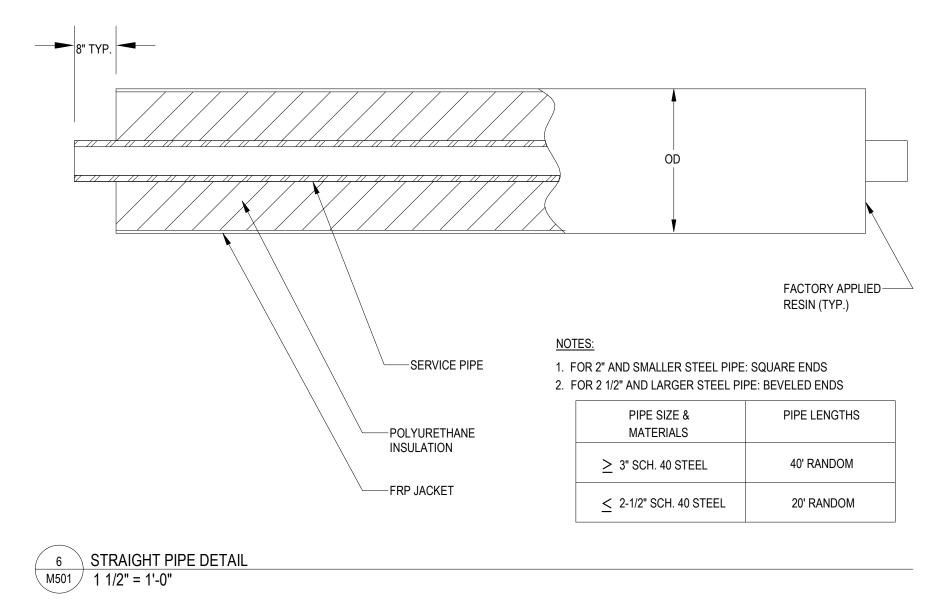


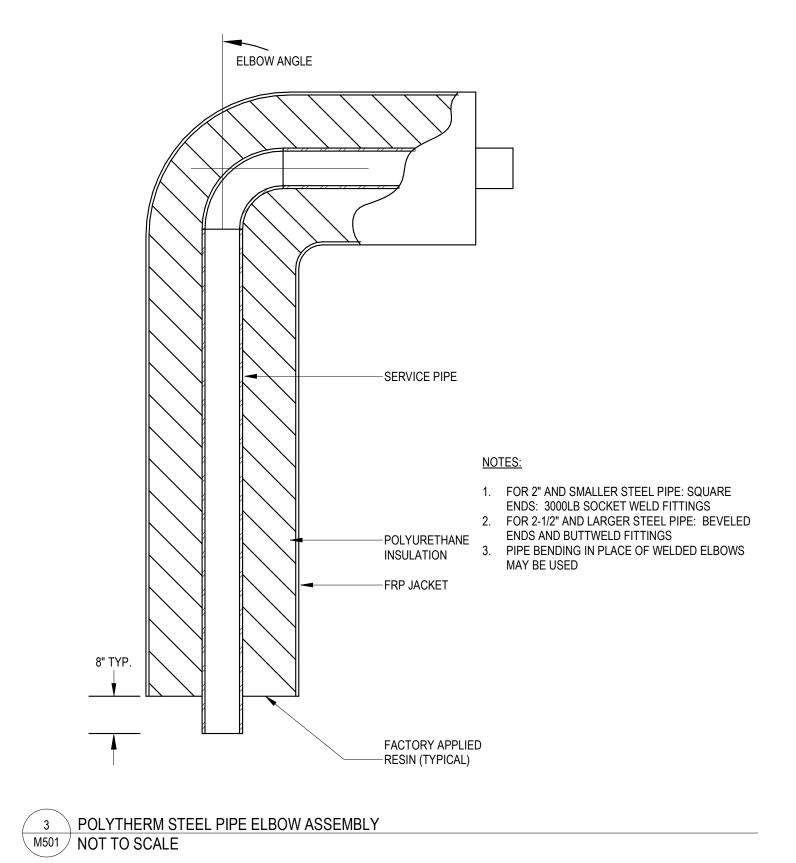


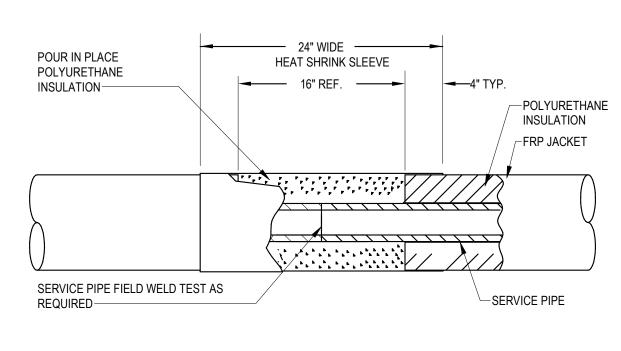
NOTES:
1. WALL SLEEVES BY MC.
2. PACKING OR LINK SEALS BY MC.
3. LINK SEAL SHALL BE RATED TO 400°F, EQUAL TO METRAFLEX.

END SEAL THROUGH WALL (OR CONCRETE FLOOR) PIPING DETAIL

M501 NOT TO SCALE

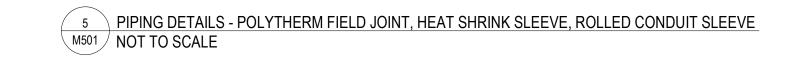


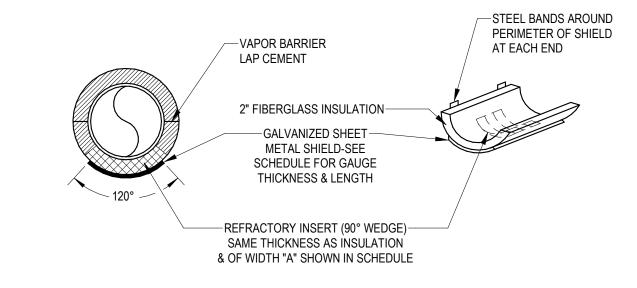




NOTES:

1. SOCKETWELD COUPLINGS, IF REQUIRED, SUPPLIED BY INSTALLER.

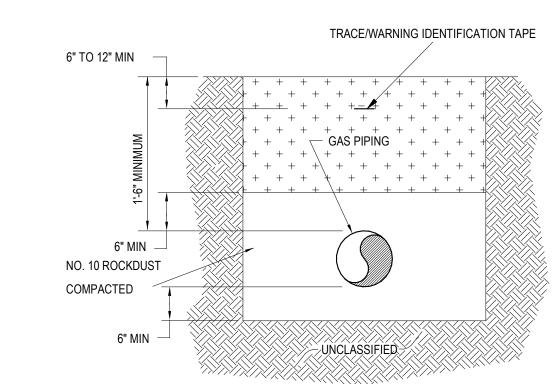




		NG SADDLE A D SCHEDULE	
PIPE SIZE	SHIELD GAUGE AND LENGTH	INSERT WIDTH "A"	
		COLD LINES	HOT OR DUAL TEMPERATURE LINES
4" THRU 6"	20 GA - 6" LG	4"	4"
8" THRU 10"	16 GA - 9" LG	4"	4"
12" THRU 18"	16 GA - 12" LG	6"	6"
20", 24", & 30"	18 GA - 18" LG	8"	8"

PIPE INSULATION SADDLE AND SHIELD DETAIL

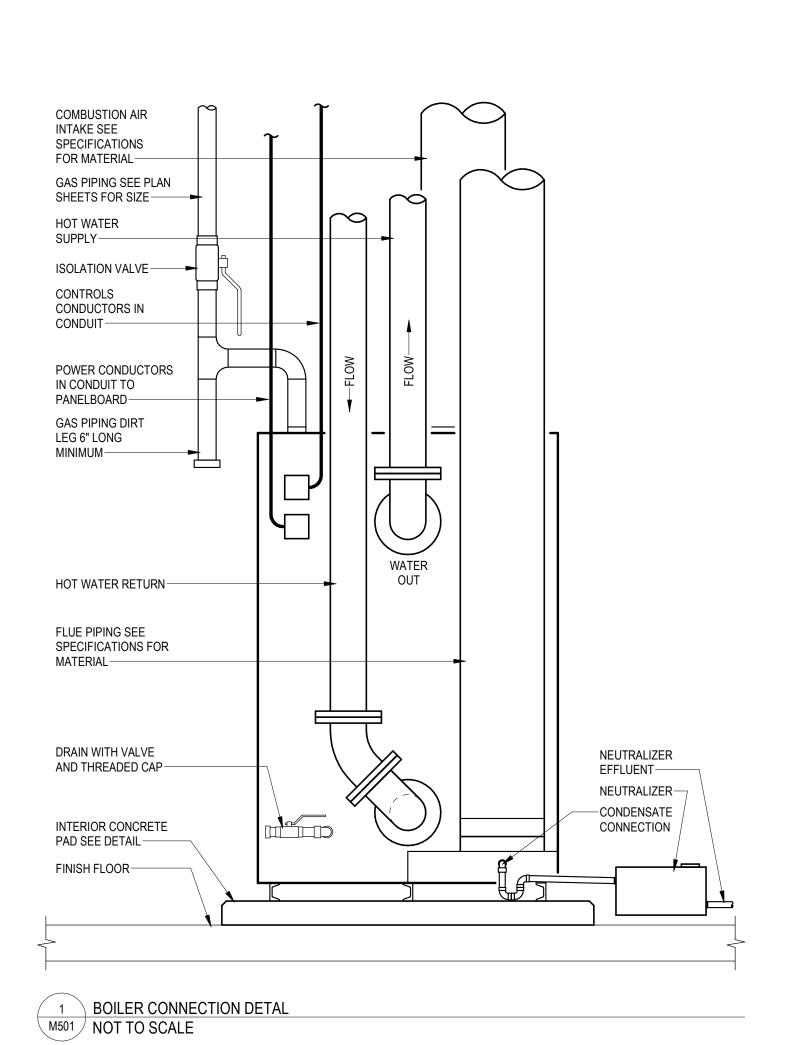
M501 NOT TO SCALE



# NOTES:

- CONTRACTOR SHALL PROVIDE GAS PIPING, TRENCHING, BACKFILL, TRACE WIRE, ETC.
   THE TRENCH BOTTOM SHALL GIVE UNIFORM SUPPORT ALONG THE ENTIRE LENGTH OF THE PIPELINES.
   GAS PIPING SHALL BE BURIED A MINIMUM OF 18" (TOP OF PIPE TO FINISH GRADE).
   THE BURIED TRACE WIRE PROVIDED BY OWNER AND MARKER TAPE SHALL BE ROUTED ABOVE THE GAS LINE FOR FUTURE SURFACE DETECTION OF PIPING LOCATION. THE TRACE WIRE SHALL BE BURIED ALONG THE ROUTE AND MARKED AS "CAUTION-BURIED GAS LINE" AT INTERVALS OF NOT GREATER THAN 123".
- 5. ALL UNDERGROUND MATERIAL IS UNCLASSIFIED. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH EXCAVATION AND BACKFILL OF UNCLASSIFIED MATERIAL.

4 DIRECT BURIAL PIPING TRENCH DETAIL NOT TO SCALE



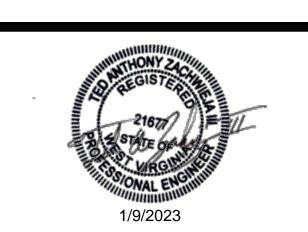


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NO DATE REVISION



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PROJECT NAME:
Building #3 Hydronic Boiler System
Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

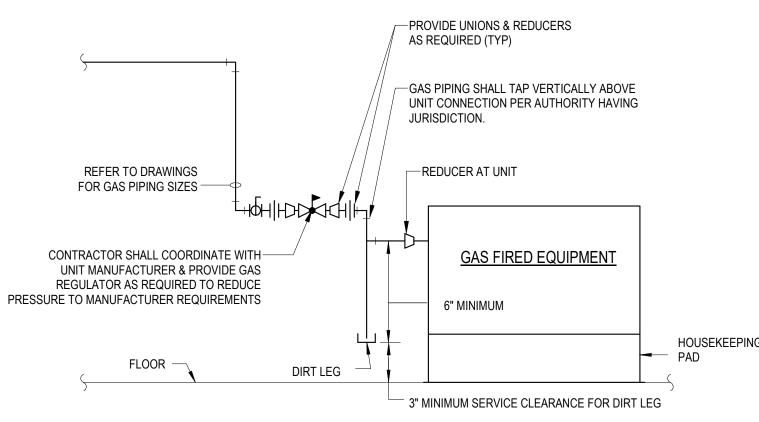
MECHANICAL DETAILS

FILE: XXX
DRAWN BY: MWE
CHECKED BY:TZ3
PROJ. NO: GSD-221-C
DRAWING NO:

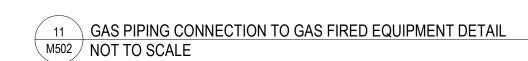
M501

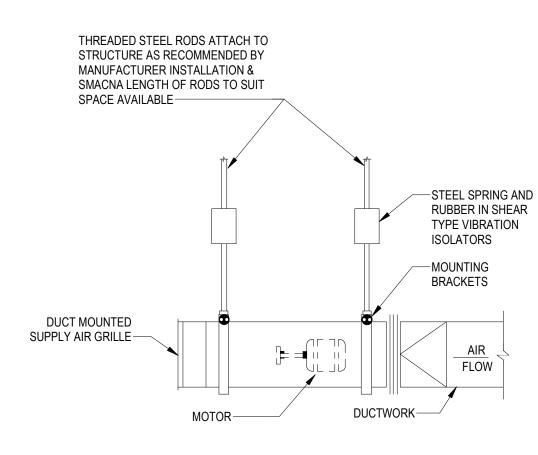
D	UCT SUPPORT S	CHEC	<u>DULE</u>
DUCT SIZE	ANGLE	ROD	MAXIMUM SPACING
UP TO 24"	1"x1"x1/8"	1/4"	10'-0"
25" TO 60"	2-1/2"x1-1/2"x1/8" LLV	3/8"	8'-0"

1 DUCT SUPPORT DETAIL M502 NOT TO SCALE

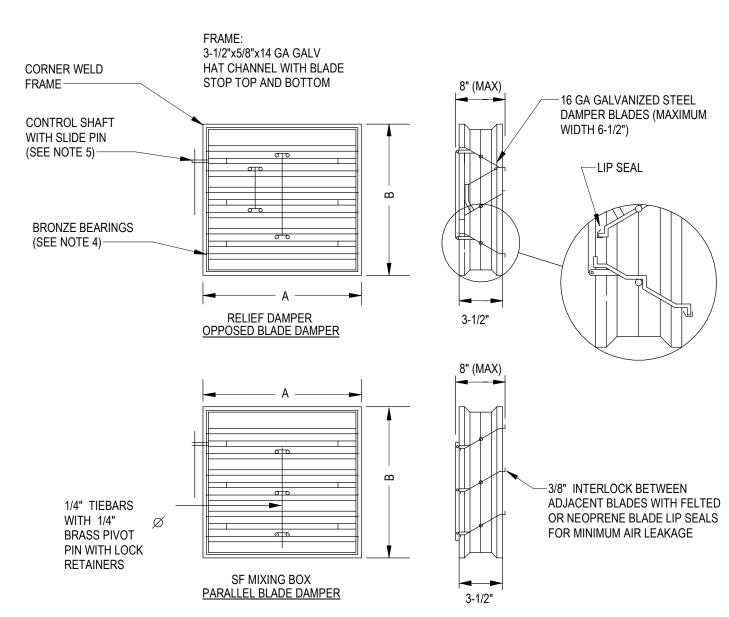


1. CONTRACTOR SHALL ROUTE GAS LINE FULL SIZE INDICATED ON DRAWINGS AND ONLY REDUCE AT UNIT FOR FINAL CONNECTION AS REQUIRED.





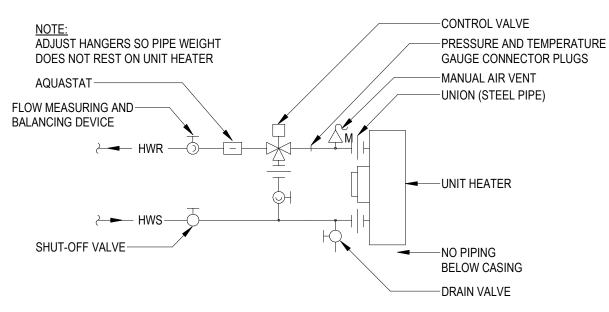
3 IN-LINE FAN SUPPORT DETAIL M502 NOT TO SCALE



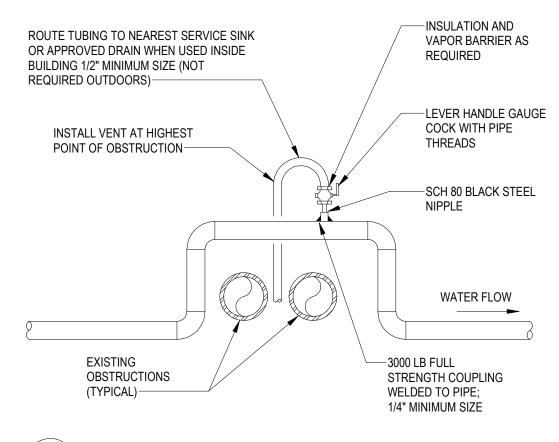
NOTES:

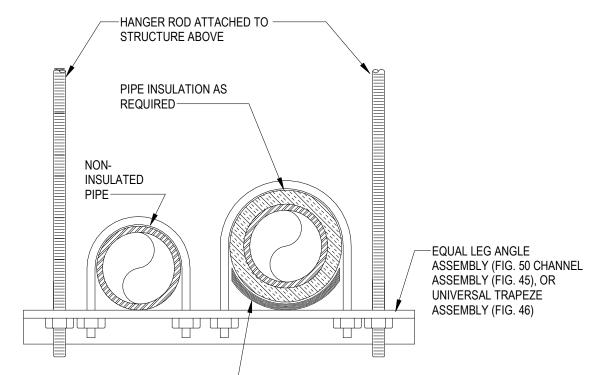
1. MAXIMUM WIDTH, A, 48" PER SECTION

- 2. MAXIMUM HEIGHT, B, 72" PER SECTION 3. S.S. JAMB TO BLADE WINDSTOP NOT SHOWN
- 4. SELF LUBRICATING BRONZE BEARINGS WITH 1/2" SLIDE PINS ON END OF BLADES 5. CADMIUM PLATED CONTROL SHAFT 1/2" OR 3/8" SQUARE EXTENDED 6" BEYOND FRAME WITH SLIDE PIN CONTROL 6. PROVIDE OPPOSED BLADE DAMPERS FOR ALL AIR HANDLING UNIT OUTSIDE AIR, RELIEF AIR, AND RETURN DAMPERS.
- 4 LOW LEAKAGE RECTANGULAR DAMPERS M502 NOT TO SCALE

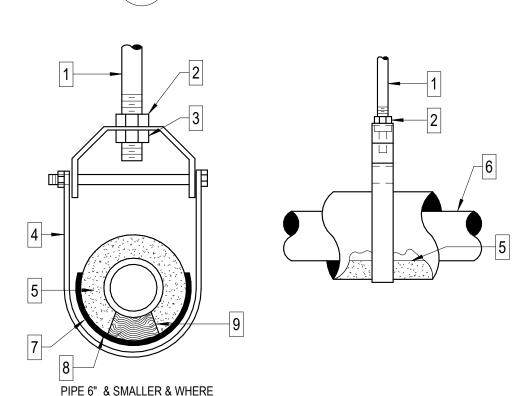


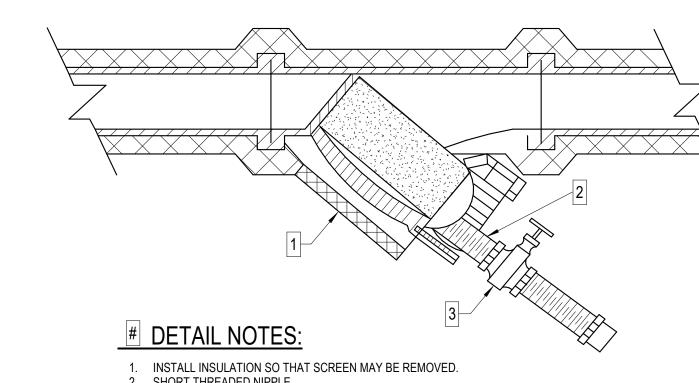
5 HOT WATER UNIT HEATER PIPING DETAIL W/3-WAY VALVE M502 NOT TO SCALE





REQUIREMENT WITH SAFETY FACTOR OF 5.





SHORT THREADED NIPPLE. 3. BALL VALVE WITH 3/4" THREADED END CONNECTION WITH CHAIN AND CAP.

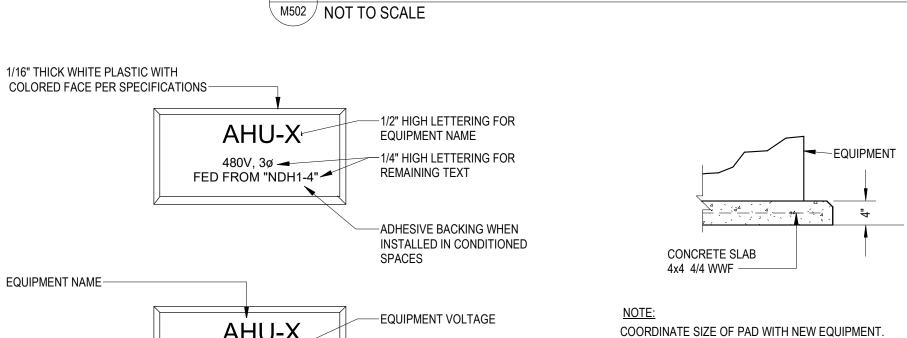
12 STRAINER DETAIL TYPICAL

TO BUILDING #5

480V, 3ø

FED FROM "NDH1-4"

TYPICAL EQUIPMENT



12" HPS

CAP 6" HPS AT TEE

<u>PLAN VIEW</u>

NOT TO SCALE

AND REMOVE-

-FASTEN WITH BRASS SCREWS WHEN LOCATED IN NON-13 INDOOR HOUSEKEEPING PAD DETAIL CONDITIONED OR EXTERIOR M502 / NOT TO SCALE -EQUIPMENT SOURCE (PANEL AND CIRCUIT)

12" HPS

-CAP 6" HPS AT EXTERIOR

OF VAULT AND ABANDON 6" HPS UNDERGROUND.

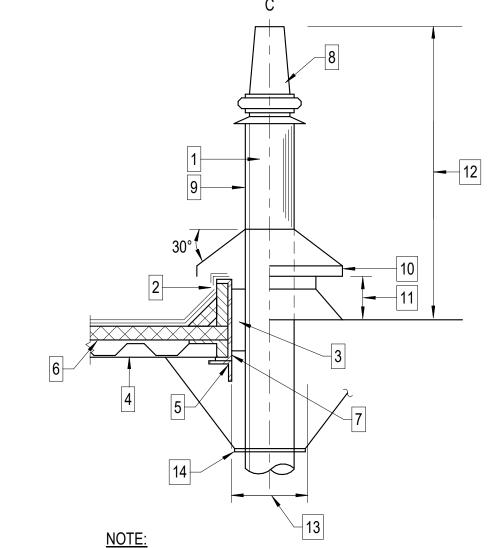
TO MH #2

DEMOLISH 6" HPS TO OUTSIDE OF

MH-3 AND SEAL CONCRETE VAULT

RATING OF SEAL SHALL BE ABOVE

WATER TIGHT FOR PIPE PENETRATION. TEMPERATURE





- LOCKING NUT. SUPPORT NUT. HEAVY DUTY CLEVIS HANGER. INSULATION (WHERE REQUIRED).
- 7. 14 GAUGE ZINC COATED SHEET B. STEEL SADDLE AT LEAST 6" LONG. 9. WOOD BLOCKS.

	UF	102		3/0 DI	<u> </u>	4 111	KU 3		3/0	DIA			
	2-1/2	2" TH	RU 3"	1/2" DI	A	6" TH	RU 1	2"	7/8'	' DIA			
				HANGE	R RO	D SPACINO	3						
PIPE SIZE		1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"
MAXIMUM LLOWABL SPACING	E	7 FT	8 FT	9 FT	10 FT	11 FT	12 FT	14 FT	16 FT	17 FT	19 FT	22 FT	23 FT

HANGER ROD SCHEDULE



- **DETAIL NOTES:** 1 MINIMUM BOILER OUTLET SIZE.
- 2 2"x2"x18 GAUGE FLASHING ANGLE.
- 3 VENTILATED ROOF THIMBLE I ACCORDANCE WITH

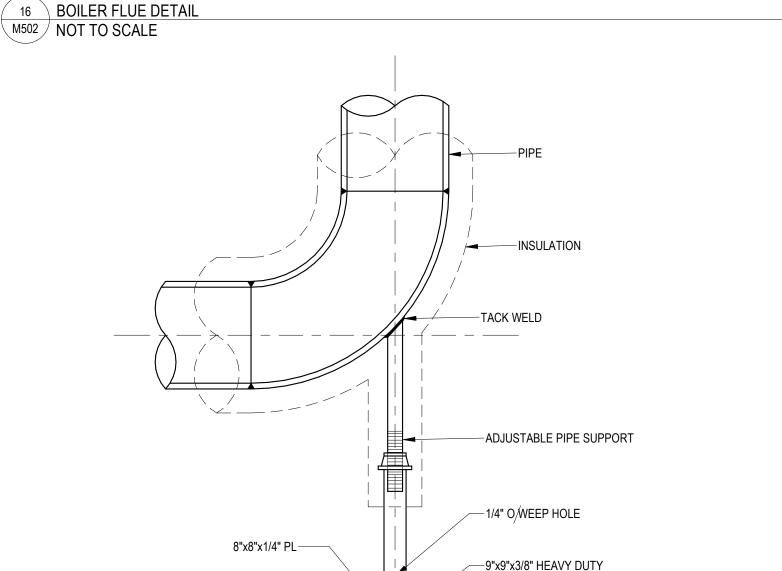
FINISHED FLOOR

8 PIPE SUPPORT DETAIL

M502 NOT TO SCALE

- NFPA/BOCA. 4 ROOF DECK.
- 5 3"x3"x1/4" ANGLE ALL AROUND WELDED TO BAR JOIST. 6 RIGID INSULATION.
- 7 2"x10" CHANNEL WELDED TO ANGLE.
- 12 3'-0" (MINIMUM) ABOVE ANY STRUCTURE WITHIN 10'-0" OF FLUE OUTLET.

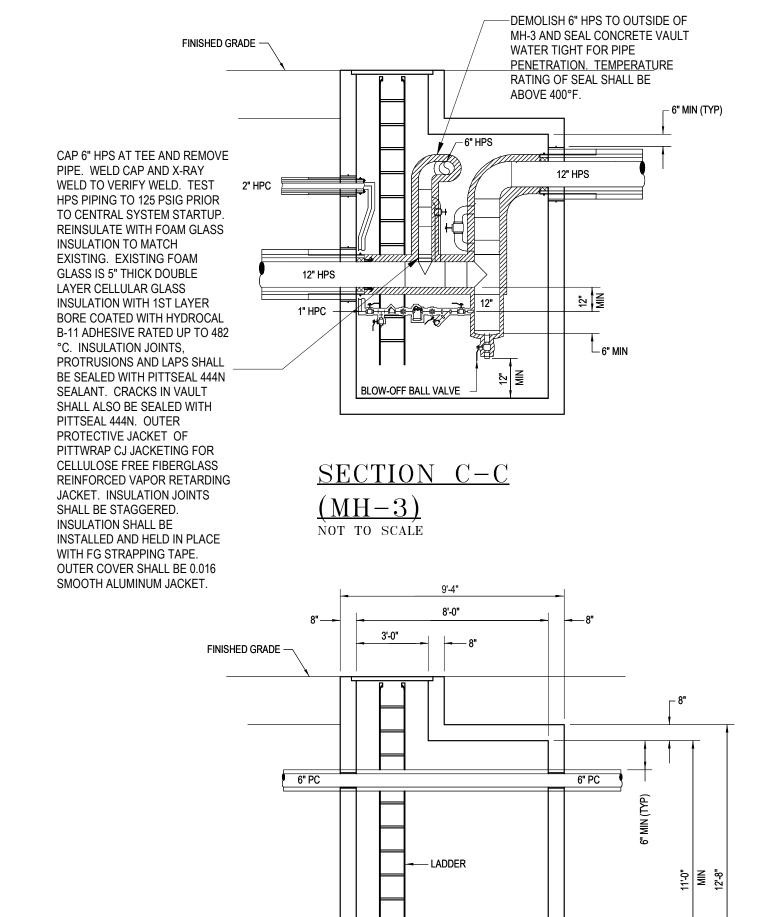
14 FLUE SUPPORT



CONDENSATE TRAP MUST BE INSTALLED AT THE SAME LEVEL OR BELOW THE BOILER BASE. BASE OF NEUTRALIZER TANK MUST BE MINIMUM 3" LOWER THAN THE CONDENSATE TRAP. 6. CONNECT WIRING FROM CONDENSATE TRAP INTO THE CONNECTOR LOCATED ON THE BOILER UNIT. 15 BOILER CONDENSATE ACID NEUTRALIZER DETAIL M502 NOT TO SCALE

CONDENSATE TRAP—

HOUSEKEEPING PAD-



SECTION C-C (MH-3)NOT TO SCALE

14 EXISTING MANHOLE #3 DETAILS
M502 NOT TO SCALE

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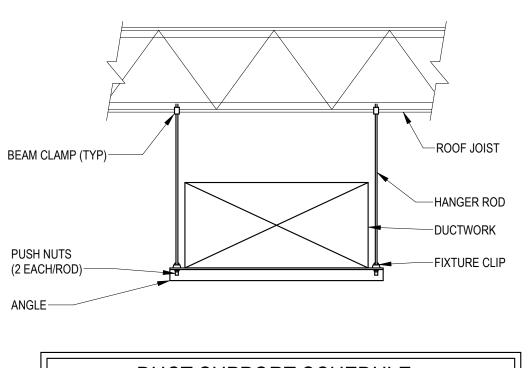
Upgrades

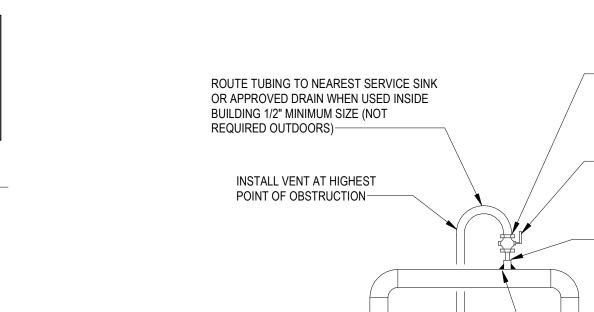
DRAWING TITLE: MECHANICAL DETAILS

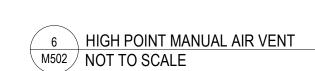
FILE: XXX DRAWN BY: TZ3 CHECKED BY:TZ3 PROJ. NO: GSD-221-C

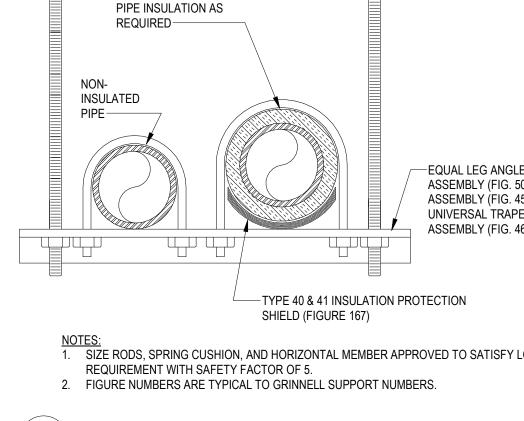
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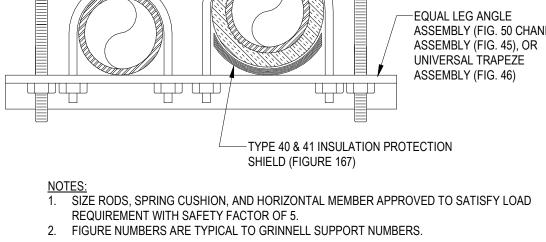
**M502** 

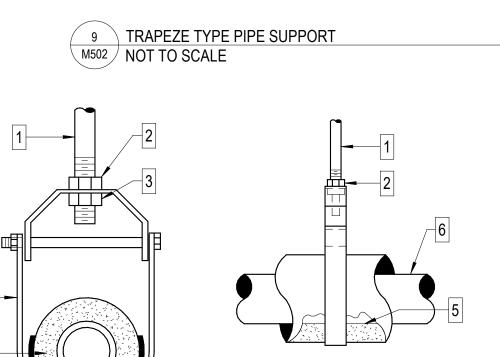


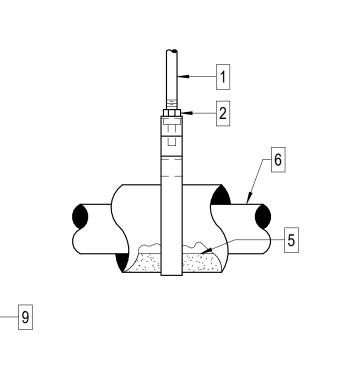


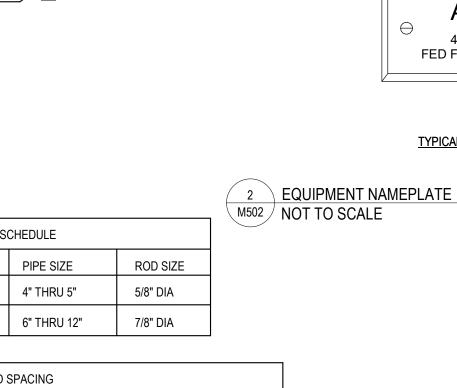












-FACTORY PROVIDED 3/8" SILICONE HOSE VENT LINE WITH HOSE CLAMPS.

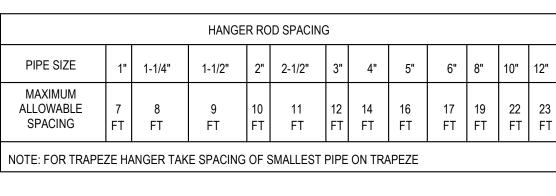
-FACTORY PROVIDED CONTRACTOR INSTALLED CONDENSATE TRAP.

-FACTORY PROVIDED CONTRACTOR INSTALLED

🗀 to floor drain 🕒

CONDENSATE NEUTRALIZER TANK.

**EQUIPMENT NAME-**



-1" PVC CONDENSATE DRAIN.

-VACUUM BREAK

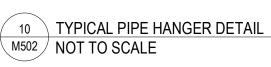
1. CONNECT THE NEUTRALIZER END OUTLET TO FLOOR DRAIN, MAKING SURE THE DRAIN LINE RUNS LEVEL

DO NOT OPERATE THE CONDENSATE NEUTRALIZER TANK OR THE APPLIANCE CONDENSATE TRAP DRY. FACTORY SUPPLIED CONDENSATE NEUTRALIZER KIT LOCHINVAR MODEL CN6T WITH CLEAR TANK FOR

OR CONTINUOUSLY DOWNHILL. DRAIN LINE MUST NOT BE HIGHER THAN THE TEE AT JACKET

-CONDENSATE PIPING

MECH ROOM FLOOR



REQUIRED TO AVOID SPACE CONFLICTS

- 11 18" MINIMUM CONE FLASHING.
- 13 FRAMING DIMENSION (INSIDE DIMENSION) APPROXIMATELY  $\Box$  18" FOR INSTALLATION OF VENTILATED ROOF THIMBLE.

NEOPRENE PAD

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1. INCLUDE PRESSURE RELIEF VALVE FOR 100 PSI. PROVIDE AND INSTALL THE FACTORY SUPPLIED CONDENSATE NEUTRALIZER KIT LOCHINVAR MODEL CN6T WITH CLEAR TANK FOR EACH BOILER.

3. DIRECT EXHAUST VERTICALLY THROUGH ROOF, CONTRACTOR SHALL INCLUDE ALL NECESSARY STAINLESS STEEL PIPING, PIPE ACCESSORIES PER MANUFACTURER'S RECOMMENDATIONS FOR A COMPLETE AND OPERABLE SYSTEM. EXHAUST FLUE MUST BE UL LISTED, CATEGORY IV APPROVED STAINLESS STEEL SEALED VENT MATERIAL.

4. DIRECT COMBUSTION AIR INTAKE THROUGH ROOF VENT TERMINATION, CONTRACTOR SHALL INCLUDE ALL NECESSARY PIPE ACCESSORIES PER MANUFACTURER'S RECOMMENDATIONS FOR A COMPLETE AND OPERABLE SYSTEM.

6. GAS TRAIN SHALL BE CSD-1 COMPLIANT AND INSTALLED BY MANUFACTURER. ROUTE VENT LINES IN ACCORDANCE WITH MFG RECOMMENDATIONS. INSTALL ALL NECESSARY ACCESSORIES WITH GAS TRAIN IN ACCORDANCE WITH MFG RECOMMENDATIONS FOR A COMPLETE AND OPERABLE SYSTEM.
7. PROVIDE AND INSTALL A NATURAL GAS PRESSURE REGULATOR AS REQUIRED TO ACCEPT 2 PSI GAS PRESSURE AND REDUCE TO REQUIRED PRESSURE FOR PROPER BOILER OPERATION.

8. PROVIDE BACNET IP/MSTP INTERFACE AND COORDINATE WITH DDC CONTROLS CONTRACTOR FOR INTERFACE TO TRANE ENSEMBLE CONTROLS.

PROVIDE AND INSTALL COMBUSTION AIR AND FLUE GAS PIPING ACCESSORIES REQUIRED FOR ROOF VENT TERMINATIONS. 10. PROVIDE AND INSTALL THE FACTORY SUPPLIED CONDENSATE TRAP, PIPING, VENT HOSE, AND WIRING CONNECTION TO BOILER. 11. PROVIDE AND INSTALL FACTORY SUPPLIED ELECTRICAL TRANSFORMER SHIPPED LOOSE FOR FIELD INSTALLATION.

					(	CIRCUL	ATING	PUM	P SCF	HEDUL	.E								
						P	UMP				MOTOR								
						FLO	OW		DRIVE				UNIT						
ID	SYSTEM NAME	MANUFACTURER	MODEL NO.	TYPE	TYPE	DESIGN	MIN	HEAD	TYPE	POWER	RPM	ECM	WEIGHT	FLA	MCA	MOCP	VOLT	PH	REMARKS
HWP-01	HWR 3	GRUNDFOS	TPE3 80-180	INLINE	CIRCULATOR	240.0 GPM	0.0 GPM	40.0 FT	DIRECT	3.00 hp	3900	Yes	130 lb	7.6 A	9.5 A	17.1 A	208 V	3	1,2,3,4,5,6
HWP-02	HWR 3	GRUNDFOS	TPE3 80-180	INLINE	CIRCULATOR	240.0 GPM	0.0 GPM	40.0 FT	DIRECT	3.00 hp	3900	Yes	130 lb	7.6 A	9.5 A	17.1 A	208 V	3	1,2,3,4,5,6
HWP-03	HWR 3	GRUNDFOS	TPE3 80-180	INLINE	CIRCULATOR	240.0 GPM	0.0 GPM	40.0 FT	DIRECT	3.00 hp	3900	Yes	130 lb	7.6 A	9.5 A	17.1 A	208 V	3	1,2,3,4,5,6

1. TRIM IMPELLER TO PROVIDE MAXIMUM HEAD USING HP'S SPECIFIED AND NON-OVERLOADING THROUGH-OUT THE ENTIRE PUMP CURVE.

. SIZE PUMPS BASED UPON 100% WATER.

5. BOILERS SHALL BE SELECTED BASED UPON 100% WATER.

PUMPS SHALL BE BRONZE FITTED. PROVIDE WEAR RINGS ON ALL PUMPS.
 ALL INVERTER RATED MOTORS SHALL HAVE BEARING PROTECTION RING EQUAL TO AEGIS SGR.

5. MECHANICAL CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR. ELECTRICAL CONTRACTOR SHALL FURNISH ALL DISCONNECTS/STARTERS FOR PUMPS. 6. PROVIDE FACTORY UNIT MOUNTED COMBINATION VFD, STARTER, AND REMOTE WALL MOUNTED DISCONNECT.

			CONTROL VA	ALVE SCH	EDULE				
						VALVE PRO	PERTIES		
ID	ID	DESCRIPTION	MANUFACTURER	MODEL	MATERIAL	Maximum Allowable Working Temperature	Maximum Allowable Working Pressure		NOTES
ETP-1	SOLENOID	ELECTRONIC TRAP PRIMER SOLENOID VALVE	SIOUX CHIEF MANUFACTURING	695-ES01	SS ARRESTOR/BRASS SOLENOID	140 °F	99.7 psi	1	
SGV-1	SOLENOID	NATURAL GAS SOLENOID VALVE	AMERICAN GAS SAFETY	MERLIN 1080	DIE CAST ALUMINUM	145 °F	2.0 psi	2	
IOTES:		ISIST OF SURGE ARRESTER, VACUUM BREAKER		C EVTENCION 120V	(/CO Hz @ 0.2 Watto				

2. VALVE APPROVAL: UL YLOZ AUTOMATIC SHUT OFF VALVE, AGA & CGS C20300014, ANSI Z21.21-CGA6.5, FM CSD-1.

1. INSULATE ROOF DRAIN BODY AND ALL STORM SEWER PIPING.

. PAINT ROOF DRAIN STRAINER SAFETY YELLOW. PROVIDE LOW SILHOUETTE ALUMINUM DOME.

**EXPANSION TANK SCHEDULE** ACCEPTANCE MAX ACCEPTANCE PRESS PRECHARGE UNIT DIMENSIONS UNIT VEIGHT ASME WEIGHT NO. MANUFACTURER MODEL NO. ARRANGEMENT VOL VOL REMARKS STEEL - RED OXIDE HEATING WATER FIXED VERTICAL 211.0 gal 84.0 gal POLYPROPYLENE LINING PRIMER MECHANICAL B-M5 AMTROL AX-280V 0.40 100 psi 12 psi 30" 82" Yes 2352 lb

								НО	ΓWA	TER	UNIT HE	ATER	SCHE	DULE										
	LOCATION							FAN					HE	ATING COIL										
								MOT	OR			AIR	SIDE		WAT	ERSIDE		UNIT						
ID	NAME	NO.	MANUFACTURER	MODEL NO.	TYPE	AIRFLOW	QTY	POWER	RPM	ECM	CAP	EAT(db)	LAT(db)	FLOW	EWT	LWT	PD	WEIGHT	FLA	MCA	MOCP	VOLT	PH	REMARKS
UH-01	LOADING	LP101	STERLING	HS-118A	VERTICAL CABINET	500 CFM	1	0.02 hp	1550	No	18000 Btu/h	60.0 °F	93.3 °F	1.9 GPM	160 °F	140 °F	2.2 ftH2O	48 lb	1.0 A	1.3 A	15.0 A	115 V	1	1,2,3,4,5,6,7
UH-02	LOADING	LP101	STERLING	HS-118A	VERTICAL CABINET	500 CFM	1	0.02 hp	1550	No	18000 Btu/h	60.0 °F	93.3 °F	1.9 GPM	160 °F	140 °F	2.2 ftH2O	48 lb	1.0 A	1.3 A	15.0 A	115 V	1	1,2,3,4,5,6,7
UH-03	LOADING PAVILION & ST	LP-01	STERLING	HS-118A	VERTICAL CABINET	500 CFM	1	0.02 hp	1550	No	18000 Btu/h	60.0 °F	93.3 °F	1.9 GPM	160 °F	140 °F	2.2 ftH2O	48 lb	1.0 A	1.3 A	15.0 A	115 V	1	1,2,3,4,5,6,7
UH-04	LOADING PAVILION & ST	LP-01	STERLING	HS-118A	VERTICAL CABINET	500 CFM	1	0.02 hp	1550	No	18000 Btu/h	60.0 °F	93.3 °F	1.9 GPM	160 °F	140 °F	2.2 ftH2O	48 lb	1.0 A	1.3 A	15.0 A	115 V	1	1,2,3,4,5,6,7
UH-05	BOILER ROOM	1	STERLING	HS-125A	VERTICAL CABINET	580 CFM	1	0.03 hp	1550	No	24000 Btu/h	60.0 °F	98.3 °F	2.5 GPM	160 °F	140 °F	2.2 ftH2O	48 lb	1.0 A	1.3 A	15.0 A	115 V	1	1,2,3,4,5,6,7

1. HOT WATER PIPE CONNECTION SIZES SHALL BE CONFIRMED WITH UNIT MANUFACTURER PRIOR TO INSTALLATION.

2. M.C. SHALL PROVIDE ALL UNITS WITH LINE VOLTAGE THERMOSTATS AND 2-WAY CONTROL VALVES INTERLOCKED WITH THE OPERATION OF THE UNIT HEATER. LINE VOLTAGE STATS SHALL BE INSTALLED BY E.C. 3. SCHEDULED CAPACITIES ARE MINIMUM REQUIRED CAPACITIES.

4. SUPPLY EQUIPMENT WITH A FACTORY INSTALLED NON-FUSED DISCONNECT. 5. SELECT ALL HYDRONIC HEATING COILS BASED ON 160°F ENTERING WATER TEMPERATURE.

6. SELECT ALL HYDRONIC HEATING COILS BASED ON 100% WATER. PROVIDE HOT WATER HEATING COILS AS REQUIRED FOR INDICATED CAPACITY.

									GR	RILLES	S, REG	SISTE	RS A	AND D	IFFUSE	RS SCHE	DULE					
								NECK		DIFFUSER			BLADE D	ESIGN		INSTALLATION		OPTIO	ONS			
						FACE				TOTAL			DEFLE	CTION ANGLE			DAMPER	FILTER	EQUALIZING	HEAVY DUTY		
ID	DESCRIPTION	MANUFACTURER	MODEL	QTY	SYSTEM	SIZE	SIZE V	VIDTH   H	HEIGHT		THICKNESS	SPACING	SINGLE	DOUBLE	ORIENTATION	BORDER TYPE	DESCRIPTION	DESCRIPTION		FRAME	SPECIFICATION	NOTE
G1	EGGCRATE GRILLE	TITUS	50F	1	S/A			24"	24"			0' - 1"	0.0°		GRID	TYPE 1 (SURFACE)			No		1"x1"x1" EGGCRATE GRID.	1,2,3,4

SEE HVAC FLOOR PLANS FOR INDIVIDUAL DUCT CONNECTION SIZES.

. PROVIDE STEEL DUCT FLANGE ON WHICH TO MOUNT GRILLE. 3. COLOR FOR DIFFUSERS AND GRILLES SHALL BE SELECTED BY OWNER AND COORDINATED PRIOR TO ORDERING. 4. DUCT CONNECTION SIZES ARE LISTED ON DRAWINGS, REFER TO M001 FOR SYMBOL AND TAG INFORMATION.

5. DIFFUSERS AND GRILLES SHALL OPERATE AT A MAX NO OF 30 AT DESIGN CFM WHEN 1 DIFFUSER IS IN ROOM, NO OF 27 FOR 2, NO OF 24 FOR 3, AND NO OF 21 FOR 4 OR MORE IN THE SAME ROOM. 6. "---" IN THE FACE SIZE INDICATES THAT THE FACE SIZE MATCHES THE CONNECTION SIZE.

					FL	OOR DRA	AIN SCHE	DULE				
					MATERIAL DE	ESCRIPTION	PRIMER	WASTE	VENT	PRIMER		
ID	DESCRIPTION	MANUFACTURER	MODEL	QTY	DRAIN BODY	STRAINER	CONNECTION	PIPE SIZE	PIPE SIZE	PIPE SIZE	SPECIFICATION	REMARKS
FD-1	FLOOR DRAIN	WATTS	FD-100-A	2	EPOXY COATED CAST IRON	NICKEL BRONZE	Yes	4"	2"		EPOXY COATED CAST IRON FLOOR DRAIN WITH ANCHOR FLANGE, REVERSIBLE CLAMPING COLLAR WITH PRIMARY & SECONDARY WEEPHOLES, ADJUSTABLE ROUND HEEL PROOF NICKEL BRONZE STRAINER, AND NO HUB OUTLET.	

						RO	OF DRAIN SCI	HEDULE	
					MATERIAL DES	CRIPTION	OUTLET		
ID	DESCRIPTION	MANUFACTURER	MODEL	QTY	DRAIN BODY	STRAINER	DRAIN PIPE DIAMETER	SPECIFICATION	REMARKS
SD-1	COMBINATION DRAINS	ZURN	Z163	1	LACQUERED CAST IRON	ALUMINUM	4"	COMBINED LARGE SUMP ROOF DRAIN AND SECONDARY OVERFLOW SYSTEM; CONSISTING OF 24" X 48" GALVANIZED SUMP RECEIVER, TWO ROOF DRAIN BODIES WITH 15" DIAMETER ANCHOR FLANGE, CAST IRON WATERPROOFING MEMBRANE CLAMP RINGS WITH INTEGRAL GRAVEL STOP, ONE 4" ABS OVERFLOW STANDPIPE AND TWO SELF-LOCKING DOME STRAINERS WITH A COMBINED FREE AREA OF 250 SQUARE INCHES.	1,2,3
IOTES:									

									PLU	IMBING FIXTURE SCHEDULE	
				TRIM		FLO	OW FIXTURI	E	COLD		
							COLD WATER	MAX. MIXED WATER	1		
ID	DESCRIPTION	QTY	MANUFACTURER	MODEL	TYPE	WATER FLOW	TEMP.	TEMP.	PIPE SIZE	SPECIFICATION	REMARKS
HYD-1	EXTERIOR WALL HYDRANT	1	WOODFORD	67	MANUAL	2.5 GPM	40 °F	40 °F	3/4"	NON-FREEZE TYPE WALL HYDRANT, WITH DOUBLE CHECK BACKFLOW PREVENTER, VALVE ON THE INSIDE OF THE WALL, SPOUT WITH BACKFLOW PREVENTER, AND LOOSE KEY SOCKET ON THE OUTSIDE OF THE WALL. MAKE ARRANGEMENTS WITH THE GENERAL CONTRACTOR TO PROVIDE THE NECESSARY RECESS IN THE WALL. WHERE A RISER TO A WALL HYDRANT OCCURS IN AN OUTSIDE WALL THE CONTRACTOR SHALL INSULATE THE CHASE WITH 2" STYROFOAM INSULATION ON ALL SIDES OF THE CHASE, EXCEPT THE INSIDE WALL OF THE CHASE. PROVIDE SHUTOFF VALVE IN ACCESSIBLE LOCATION.	

									F	AN S	CHI	EDUL	E.									
	LOCATION								FAN					SOUND							INTERLOCK	
						DESIGN	PRESS		WHEEEL	DRIVE		MOTOR		PRESS	UNIT							
ID	NAME	NO.	MANUFACTURER	MODEL NO.	TYPE	AIRFLOW	ESP	RPM	TYPE	TYPE	QTY	POWER	RPM	LEVEL (dBA)	WEIGHT	FLA	MCA	MOCP	VOLT	PH	ID	REMARKS
SF-01	BOILER ROOM	1	GREENHECK	SQ-160	INLINE	2200 CFM	0.50 in-wg	1009	BACKWARD	DIRECT	1	0.75 hp	1140	59	157 lb	3.5 A	4.4 A	15.0 A	208 V	3	CD-01, CD-02	1,2,3,4,5,6,7
									INCLINED													

1. SHALL PROVIDE UNIT MOUNTED DISCONNECT. MECHANICAL CONTRACTOR SHALL FURNISH MOTOR STARTER WITH AUXILIARY CONTACTOR FOR DDC INTERFACE. COORDINATE MOTOR STARTER CONTROL VOLTAGE WITH ATC CONTRACTOR.

PROVIDE DDC THERMOSTAT CONTROL OF AIR TRANSFER FAN, ALSO PROVIDE AUXILLARY CONTACT FOR CONTROL. . FAN SHALL BE PROVIDED WITH UNIT MOUNTED ECM MOTOR ON FAN HOUSING FOR BALANCING.

PROVIDE FAN VIBRATION ISOLATION HANGERS AND PROVIDE FLEXIBLE NEOPRENE CONNECTIONS TO DUCTWORK. 6. INTERLOCK 24V MOTORIZED DAMPERS WITH FAN OPERATION. DAMPERS SHALL OPEN WHEN FAN IS ON AND CLOSE WHEN FAN IS OFF.

. PROVIDE RETURN AIR FILTER RACK WITH MERV 8 FILTER.

								LC	OUVER SCHEDU	LE										
	LOCATION									DESIGN	FREE	FREE AREA		DAMPER			DIMEN	SIONS	UNIT	
ID	NAME	NO.	SERVES	MANUFACTURER	MODEL NO.	QTY	MATERIAL	FINISH	TYPE	<b>AIRFLOW</b>	AREA	VELOCITY	PD	TYPE	DUTY TYPE	QTY	WIDTH	HEIGHT	WEIGHT	REMARKS
L-01	BOILER ROOM	1	BOILER ROOM INTAKE	GREENHECK	EVH-501	1	6063-T6 ALUMINUM	MILL	WIND-DRIVEN RAIN VERTICAL BLADE, 5" DEPTH	2200 CFM	2.1 SF	1012 FPM	0.18 in-wg	MOTORIZED DAMPER	HEAVY GAUGE	1	2' - 0"	2' - 0"	34 lb	1,2,3,4
L-02	BOILER ROOM	1	BOILER ROOM EXHAUST	GREENHECK	EVH-501	1	6063-T6 ALUMINUM	MILL	WIND-DRIVEN RAIN VERTICAL BLADE, 5" DEPTH	2200 CFM	3.2 SF	675 FPM	0.08 in-wg	MOTORIZED DAMPER	HEAVY GAUGE	1	3' - 0"	2' - 0"	23 lb	1,2,3,4

1. PROVIDE BIRDSCREEN.

2. PROVIDE LOUVER COLOR AS SELECTED BY ARCHITECT. 3. PROVIDE 5" CHANNEL FRAME THICKNESS.

4. PROVIDE 24V MOTORIZED CONTROL DAMPER INTERLOCKED TO OPEN WHEN SUPPLY FAN IS OPERATIONAL.

21677 21677
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ON FULL SIZE SHEETS

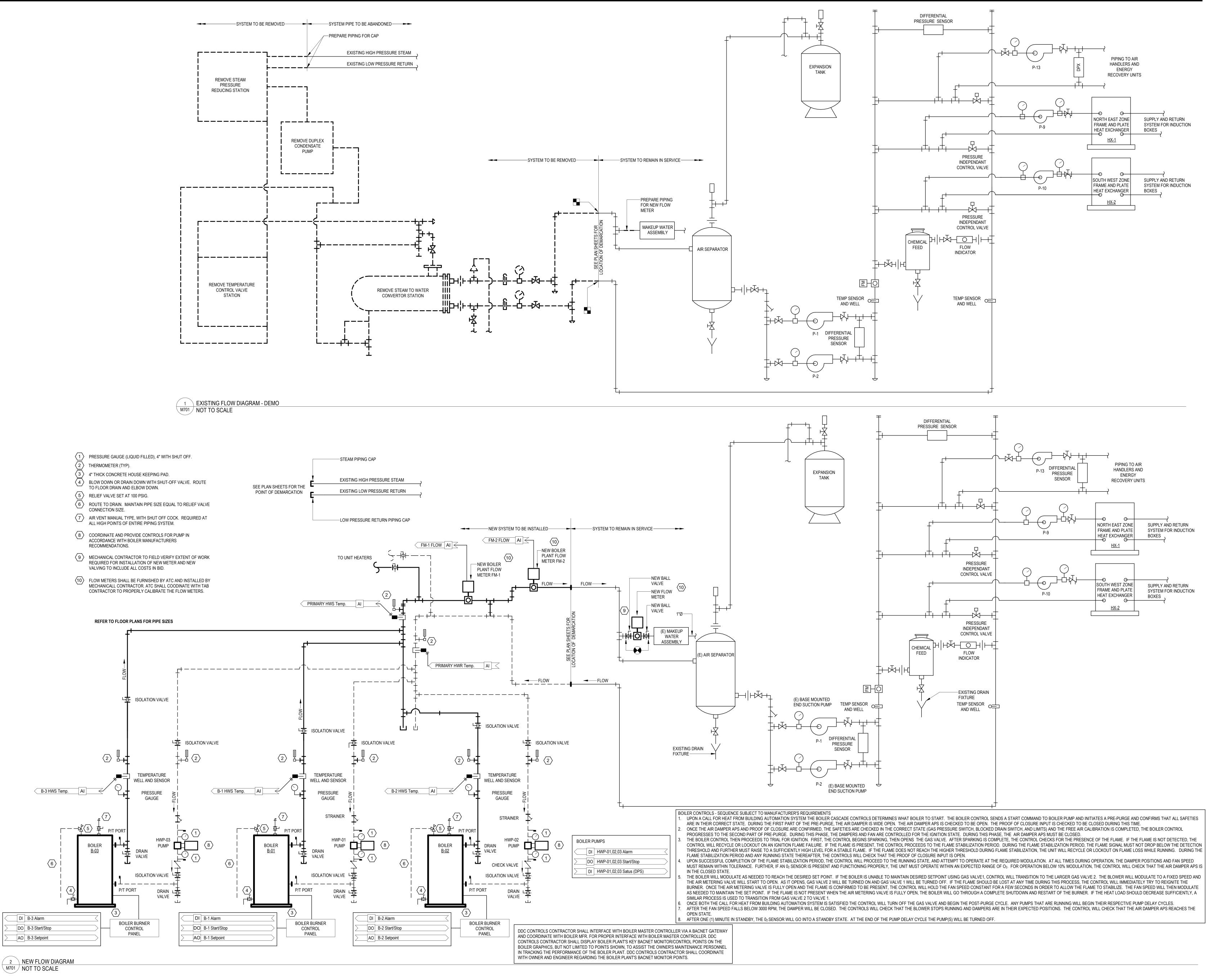
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PROJECT NAME: Building #3 Hydronic Boiler Syster

1900 Kanawha Boulevard East, Charleston, WV 25305

DRAWING TITLE: MECHANICAL SCHEDULES

FILE: XXX DRAWN BY: TZ3 CHECKED BY:TZ3 PROJ. NO: GSD-221-C DRAWING NO:



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Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

HYDRONIC FLOW DIAGRAM

FILE: XXX

DRAWN BY: MWE

CHECKED BY:TZ3

PROJ. NO: GSD-221-C

DRAWING NO:

M701

135 Corporate Center Drive Scott Depot, WV 25560

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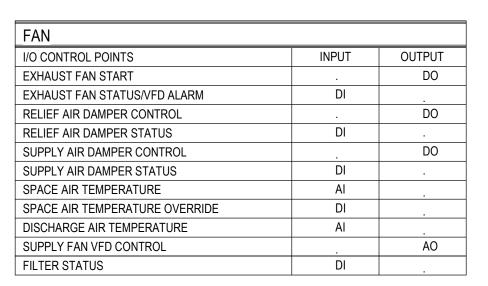
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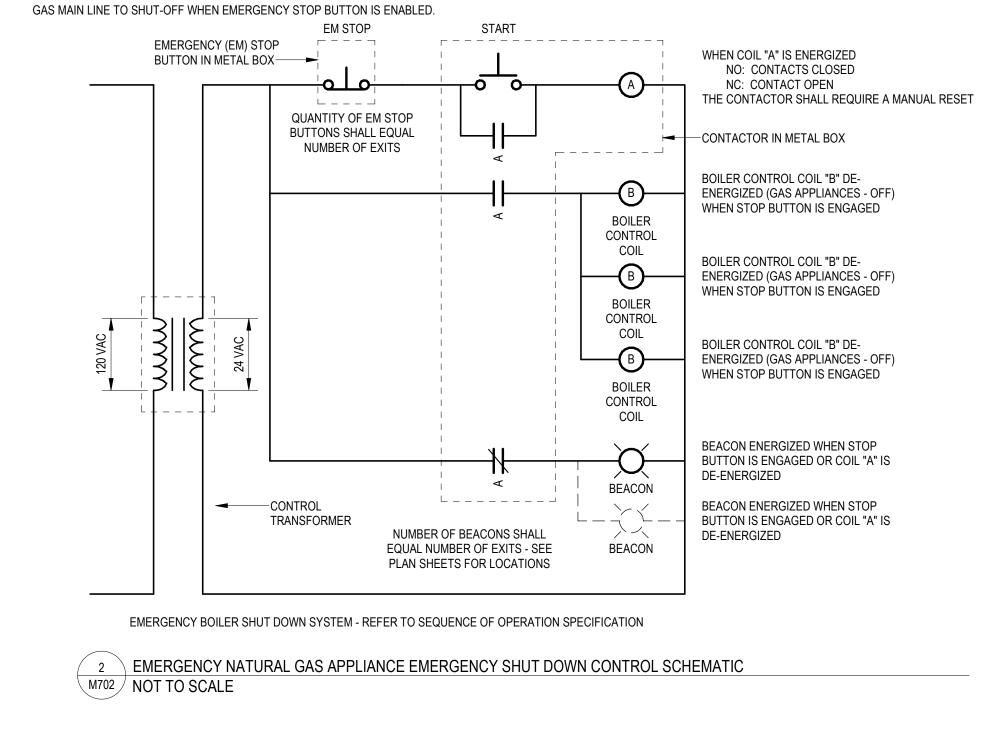
PROJECT NAME:
Building #3 Hydronic Boiler System
Upgrades

1900 Kanawha Boulevard East,

**CONTROL DIAGRAMS** 

Charleston, WV 25305





CONTRACTOR SHALL PROVIDE ELECTRIC GAS SOLENOID VALVE IN THE

	SEQUENCE OF OPERATIONS
	VENTILATION CONTROL
SENS	PERATURE
	SUPPLY AIR  FILTER WITH FILTER SWITCH  OUTSIDE A INTKAE  TO CONTROL PARTY DOLLED
	RETURN AIR

USE WEATHER PROOF SHIELD

OUTSIDE AIR TEMP

AI

4 GLOBAL OUTSIDE AIR MONITORING

M702 NOT TO SCALE

CO ALARM

DO

CO ALARM

DO

BIM 360://Building 3 Hydronic Boiler System Upgrades/GSD221C\_Bldg3-MEP.rvt

FILE: XXX

DRAWN BY: VB

CHECKED BY:TZ3

PROJ. NO: GSD-221-C

DRAWING NO:

DRAWING TITLE:

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**MP901** 

DCP DOMESTIC WATER

ELECTRICAL SYMBOL LEGEND

## PANELBOARD IDENTIFICATION **EQUIPMENT DESIGNATION** HIGH VOLTAGE 3Ø3W. 480 LOW VOLTAGE 3Ø4W. 120/208

LOW VOLTAGE 3Ø3W. 208 LOW VOLTAGE 1Ø3W. 120/240 LOW VOLTAGE 1Ø3W. 120/208 SYSTEMS DESIGNATION **EMERGENCY** POWER CONDITIONED ELECTRONIC GRADE UNINTERRUPTIBLE POWER SOURCE EQUIPMENT DESIGNATION —

# **SPECIFIC CODE NOTES**

FIRE PROTECTION REQUIREMENTS

A. PENETRATIONS IN WALLS REQUIRING PROTECTED OPENINGS MUST BE FIRESTOPPED WITH AN APPROVED MATERIAL.

 CONDUITS MAY PENETRATE WALLS OR PARTITIONS, PROVIDED THEY ARE FIRE-STOPPED. 2. OPENINGS FOR STEEL ELECTRICAL BOXES NOT EXCEEDING 16 SQUARE INCHES ARE PERMITTED PROVIDED OPENINGS DO NOT AGGREGATE MORE THAN 100 SQUARE INCHES FOR ANY 100 SQUARE FEET OF WALL OR PARTITION.

3. OUTLET BOXES ON OPPOSITE SIDES OF WALLS OR PARTITIONS MUST BE SEPARATED BY A HORIZONTAL DISTANCE OF 24 INCHES. B. LIGHT FIXTURES AND OTHER APPARATUS SUPPORTED BY THE ACOUSTICAL CEILING GRID MUST MEET THE REQUIREMENTS OF NEC SECTION 410.16,

MEANS OF SUPPORT. . RECESSED LIGHTING FIXTURES INSTALLED IN FIRE RATED CEILING ASSEMBLIES SHALL BE FIRE RATED FIXTURES BEARING THE UL FIRE RATED LABEL. FIXTURES SHALL BE INSTALLED IN ACCORDANCE WITH THE UL FIRE RESISTANCE DIRECTORY, AND SHALL INCLUDE A FIRE RATED ENCLOSURE INSTALLED OVER THE FIXTURE THAT MEETS THE REQUIREMENTS OF THE UL FIRE RESISTANCE DIRECTORY.

# **ELECTRICAL ABBREVIATIONS LIST**

IF	1 POLE (2P, 3P, 4P, ETC.)	DCP	CIDCULATING DUMP	ПІ	HEATING	INCIVIA		SWADD	SWITCHBOARD
	AMPERE	DEDT	CIRCULATING PUMP		HEATING		MANUFACTURER'S	SYM	SYMMETRICAL
A	AMPERE		DEPARTMENT		HEATER	NEDO	ASSOCIATION	SYS	SYSTEM
AC	ABOVE COUNTER OR AIR	DET	DETAIL	HV	HIGH VOLTAGE	NFDS	NON-FUSED SAFETY	TEL	TELEPHONE
	CONDITIONER	DIA	DIAMETER	HVAC	HEATING, VENTILATING AND		DISCONNECT SWITCH	TEL/DA	
	ABOVE CEILING	DISC	DISCONNECT		AIR CONDITIONING	NIC	NOT IN CONTRACT	TERM	TERMINAL
ADO	AUTOMATIC DOOR OPENER	DIST	DISTRIBUTION	HWP	HYDRONIC WATER PUMP	NL	NIGHT LIGHT	TL	TWIST LOCK
AF	AMP FRAME	DN	DOWN			N.O.	NORMALLY OPEN	TR	TAMPER RESISTANT
AFF	ABOVE FINISHED FLOOR	DPR	DAMPER	IC	INTERRUPTING CAPACITY	NPF	NORMAL POWER FACTOR	T-STAT	THERMOSTAT
AFG	ABOVE FINISHED GRADE	DS	SAFETY DISCONNECT SWITCH	IG	ISOLATED GROUND	NTS	NOT TO SCALE	TTC	TELEPHONE TERMINAL
AFI	ARC FAULT CIRCUIT	DT	DOUBLE THROW	IMC	INTERMEDIATE METAL CONDUIT				CABINET
, u i	INTERRUPTER	DWG	DRAWING		INCANDESCENT	ОН	OVERHEAD	TV	TELEVISION
AHU	AIR HANDLING UNIT	DWO	DIAWING	IR	INFRARED	OL	OVERLOADS	TVTC	TELEVISION TERMINAL
	ALUMINUM	EC	ELECTRICAL CONTRACTOR	I/W	INTERLOCK WITH	OL	OVERLOADS	1110	CABINET
				I/ V V	INTERLOCK WITH	D.4	DUDUO ADDDEGO	TVD	=
	ALTERNATE		ELECTRIC, ELECTRICAL	1.001/	HINGTION BOY	PA	PUBLIC ADDRESS	TYP	TYPICAL
	AMPERE		ELEVATOR	J-BOX	JUNCTION BOX	PB	PULL BOX OR PUSHBUTTON		
	AMPLIFIER	EM	EMERGENCY			PE	PNEUMATIC ELECTRIC	UC	UNDER COUNTER
	ANNUNCIATOR	EMS	ENERGY MANAGEMENT SYSTEM	KV	KILOVOLT	PED	PEDESTAL	UE	UNDERGROUND ELECTRICAL
<b>APPROX</b>	APPROXIMATELY	EMT	ELECTRICAL METALLIC TUBING	KVA	KILOVOLT-AMPERE	PF	POWER FACTOR	UG	UNDERGROUND
AQ-STAT	AQUASTAT	EP	ELECTRIC PNEUMATIC	KVAR	KILOVOLT-AMPERE REACTIVE	PH	PHASE	UH	UNIT HEATER
ARCH	ARCHITECT, ARCHITECTURAL	EQUIP	EQUIPMENT	KW	KILOWATT	PIV	POST INDICATING VALVE	UT	UNDERGROUND TELEPHONE
	AMP SWITCH		ELECTRIC WATER COOLER	KWH	KILOWATT HOUR	PNL	PANEL	UTIL	UTILITY
AT	AMP TRIP		EXISTING			PP	POWER POLE	UV	UNIT VENTILATOR OR
ATS	AUTOMATIC TRANSFER SWITCH		EXHAUST	LOC	LOCATE OR LOCATION	PR	PAIR	•	ULTRAVIOLET
	AUTOMATIC	EXP	EXPLOSION PROOF		LIGHT	PRI	PRIMARY		OLITAVIOLET
AUX	AUXILIARY	LAF	LAFLOSION FIXOOI		LIGHTING	PROJ	PROJECTION	V	VOLT
		ΓΛ	CIDE ALADM						
AV	AUDIO VISUAL	FA	FIRE ALARM		LIGHTNING	PRV	POWER ROOF VENTILATOR		VOLT-AMPERES
AWG	AMERICAN WIRE GAUGE	FABP	FIRE ALARM BOOSTER POWER	LV	LOW VOLTAGE	PT	POTENTIAL TRANSFORMER	VDT	VIDEO DISPLAY TERMINAL
			SUPPLY PANEL			PVC	POLYVINYL CHLORIDE	VERT	VERTICAL
BATT	BATTERY		FIRE ALARM CONTROL PANEL	MAX	MAXIMUM		(CONDUIT)	VFD	VARIABLE FREQUENCY DRIVE
BD	BOARD	FCU	FAN COIL UNIT	MAG.S	MAGNETIC STARTER	PWR	POWER	VOL	VOLUME
BLDG	BUILDING	FIXT	FIXTURE	M/C	MOMENTARY CONTACT				
BMS	BUILDING MANAGEMENT	FLR	FLOOR	MC	MECHANICAL CONTRACTOR	QUAN	QUANTITY	W	WATT
	SYSTEM	FLUOR	FLUORESCENT	MCB	MAIN CIRCUIT BREAKER			W/	WITH
		FU	FUSE	MCC	MOTOR CONTROL CENTER	RCPT	RECEPTACLE	WG	WIRE GUARD
С	CONDUIT		FUSED SAFETY DISCONNECT	MDC	MAIN DISTRIBUTION CENTER	REQD	REQUIRED	WH	WATER HEATER
CAB	CABINET	1 000	SWITCH	MDP	MAIN DISTRIBUTION PANEL	RM	ROOM	W/O	WITHOUT
	CATALOG		SWITCH		MANUFACTURER	RSC	RIGID STEEL CONDUIT	WP	WEATHERPROOF
CAT		0.4	CALICE					VVP	WEATHERPROOF
	CABLE TELEVISION	GA	GAUGE	MFS	MAIN FUSED DISCONNECT	RTU	ROOF TOP UNIT	VEND	TRANSFORMER
CB	CIRCUIT BREAKER	GAL	GALLON		SWITCH			XFMR	TRANSFORMER
			GALVANIZED	MH	MANHOLE	SC	SURFACE CONDUIT	XFR	TRANSFER
CKT	CIRCUIT	GC	GENERAL CONTRACTOR	MIC	MICROPHONE	SEC	SECONDARY		
CLG	CEILING	GEN	GENERATOR	MIN	MINIMUM	SHT	SHEET		
COMB	COMBINATION	GFI	GROUND FAULT CIRCUIT	MISC	MISCELLANEOUS	SIM	SIMILAR Ē		
CMPR	COMPRESSOR		INTERRUPTER	MLO	MAIN LUGS ONLY	S/N	SOLID NEUTRAL		
	CONNECTION	GFP	GROUND FAULT PROTECTOR	MMS	MANUAL MOTOR STARTER	SPEC	SPECIFICATION		
	CONSTRUCTION	GND	GROUND	MOA	MULTIOUTLET ASSEMBLY	SPKR	SPEAKER		
	CONTINUATION OR	GRS	GALVANIZED RIGID STEEL	MSP	MOTOR STARTER PANELBOARD	SP	SPARE	Δ	NAGLE
00111	CONTINUOUS	OITO	(CONDUIT)	MSBD	MAIN SWITCHBOARD	SR	SURFACE RACEWAY		T
CONTD	CONTRACTOR	CVD DD	GYPSUM BOARD	MT	MOUNT	SS	STAINLESS STEEL	_	D <b>EL</b> TA
		GILDD	G I L SOIN DOWND						
	CONVECTOR	1104	LIANDO OFF AUTOMATIC	MT.C	EMPTY CONDUIT	SSW	SELECTOR SWITCH		EET
CP	CIRCULATING PUMP	HOA	HANDS-OFF-AUTOMATIC	MTS	MANUAL TRANSFER SWITCH	S/S	STOP/START PUSHBUTTONS		NCHES
CRT	CATHODE-RAY TUBE		SWITCH	MTR	MOTOR, MOTORIZED	STA	STATION		IUMBER
CT	CURRENT TRANSFORMER		HORIZONTAL			STD	STANDARD		PHASE
CTR	CENTER	HP	HORSEPOWER	N.C.	NORMALLY CLOSED	SURF	SURFACE MOUNTED		ENTER LINE
CU	COPPER	HPF	HIGH POWER FACTOR	NEC	NATIONAL ELECTRICAL CODE	SW	SWITCH	P P	LATE

## **ELECTRICAL SYMBOL NOTES**

THE LIGHTING FIXTURE TYPE IS INDICATED BY AN UPPER CASE LETTER. THE CIRCUIT DESIGNATION IS INDICATED BY A NUMBER. THE SWITCH DESIGNATION IS INDICATED BY A LOWER CASE LETTER. A2 EXAMPLE 1: LIGHTING FIXTURE TYPE "A" IS CONNECTED TO CIRCUIT 12 AND CONTROLLED BY SWITCH "b".

1P 1 POLE (2P, 3P, 4P, ETC.)

EXAMPLE 2: THE FIXTURE TYPE SHOWN AS A NUMERATOR INDICATES ALL LIGHTING , FIXTURES IN THE ROOM OR SPACE ARE THE SAME TYPE. THE CIRCUIT NUMBER AND <sup>\*」</sup>SWITCH DESIGNATION SHOWN AS A DENOMINATOR INDICATES ALL LIGHTING FIXTURES IN THE ROOM OR SPACE ARE CONNECTED TO THE SAME CIRCUIT, CONTROLLED BY THE SAME LPN-102 SWITCHES, CENTER/OUTBOARD MULTILEVEL SWITCHING. EXIT LIGHTS. STEM INDICATES WALL MOUNTING. NO STEM INDICATES CEILING MOUNTING SHADED AREA INDICATES ILLUMINATED FACE(S). ARROW INDICATES DIRECTIONAL ARROW

ON ILLUMINATED FACE(S). THE CIRCUIT DESIGNATION IS INDICATED BY A NUMBER. EXAMPLE: THE WALL MOUNTED EXIT LIGHT TYPE "E" WITH SINGLE FACE AND DIRECTIONAL ARROW IS CONNECTED TO CIRCUIT 14. DEVICES. THE CIRCUIT DESIGNATION IS INDICATED BY A NUMBER. THE SWITCH DESIGNATION IS INDICATED BY A LOWER CASE LETTER. EXAMPLE: SPLIT DUPLEX RECEPTACLE IS CONNECTED TO CIRCUIT 16 AND ONE RECEPTACLE OUTLET IS CONTROLLED BY SWITCH "c".

THE CONTROL DEVICE DESIGNATION IS INDICATED BY A LOWER CASE LETTER. EXAMPLE: SINGLE POLE SWITCH "d" TO CONTROL LIGHTING FIXTURES INDICATED BY "d". WALL BOX DIMMER WITH SIZE AS INDICATED AT DEVICE. EXAMPLE: 600 WATT WALL BOX

DIMMER TO CONTROL LIGHTING FIXTURES INDICATED BY "e". SEE SPECIFICATIONS FOR WATTAGE IF NOT INDICATED. SPECIAL CONNECTIONS. THE EQUIPMENT IS INDICATED BY A NUMBER IN A CIRCLE. SEE THE MOTOR AND EQUIPMENT SCHEDULE FOR THE LOAD DESCRIPTION AND TYPE OF CONNECTION. THE CIRCUIT DESIGNATION IS INDICATED BY A NUMBER(S) ADJACENT TO THE SYMBOL. EXAMPLE: EQUIPMENT NO. 1: 3 PHASE CONNECTION TO CIRCUITS 1, 3, 5.

MOTOR CONNECTIONS. THE MOTOR IS INDICATED BY A NUMBER WITHIN OR CHARACTERS ADJACENT TO THE MOTOR SYMBOL. SEE THE MOTOR AND EQUIPMENT SCHEDULE FOR THE MOTOR DESCRIPTION AND ELECTRICAL REQUIREMENTS. THE CIRCUIT DESIGNATION IS INDICATED BY A NUMBER(S) ADJACENT TO THE SYMBOL. EXAMPLE: MOTOR SF-1; 3 PHASE CONNECTION TO CIRCUITS 2, 4, 6.

ELECTRIC HEATER CONNECTIONS. THE HEATER TYPE IS INDICATED BY A NUMBER FOLLOWING THE UPPER CASE LETTER "H". SEE THE HEATER SCHEDULE FOR ELECTRICAL REQUIREMENTS. THE CIRCUIT DESIGNATION IS INDICATED BY A NUMBER(S) ADJACENT TO THE HEATER. EXAMPLE: ELECTRIC BASEBOARD HEATER TYPE "H1" CONNECTED TO CIRCUITS 7, 9. TRANSFORMERS. THE TRANSFORMER TYPE IS INDICATED BY A NUMBER FOLLOWING THE UPPER CASE LETTER "T". SEE THE TRANSFORMER SCHEDULE OR THE SINGLE LINE

TRANSFORMER TYPE "T1". PANELBOARDS. PANELBOARD DOORS MAY BE SHOWN TO INDICATE OPENING SIDE OF RECESSED PANELBOARDS. SEE PANELBOARD IDENTIFICATION FOR DESIGNATION

DIAGRAM FOR THE TRANSFORMER DESCRIPTION AND REQUIREMENTS. EXAMPLE:

NATIONAL ELECTRICAL SWBD SWITCHBOARD

SPECIAL NOTE. SEE THE SPECIAL NOTES ON THAT SHEET FOR THE NOTE NUMBER INDICATED IN THE HEXAGON

HOME RUN TO BRANCH CIRCUIT PANELBOARD. THE PANELBOARD DESIGNATION IS SHOWN ADJACENT TO THE HOME RUN ARROW AS A NUMERATOR AND THE CIRCUIT DESIGNATION IS SHOWN AS THE DENOMINATOR. CIRCUIT BREAKER SIZES (AMPS/NUMBER OF POLES) ARE SHOWN IN THE PANELBOARD SCHEDULE WITH THE CORRESPONDING PANELBOARD AND CIRCUIT DESIGNATION. EXAMPLE: HOME RUN TO PANELBOARD LPN-102; CIRCUITS 1, 3, 5.

SYMBOL NOTATIONS: UPPER CASE LETTERS ADJACENT TO SYMBOLS INDICATE A UNIT TYPE. SEE APPROPRIATE SCHEDULE OR SPECIFICATIONS.

### GENERAL ELECTRICAL NOTES

REFER TO OTHER SHEETS FOR ADDITIONAL GENERAL NOTES. N.E.C. SHALL INDICATE: THE CURRENT STATE ADOPTED EDITION OF NFPA 70.

ICC SHALL INDICATE: THE CURRENT STATE ADOPTED EDITION OF THE INTERNATIONAL CODE COUNCIL. THE SUBMISSION OF A PROPOSAL SHALL BE CONSTRUED AS EVIDENCE THAT THE CONTRACTOR HAS FAMILIARIZED HIMSELF WITH THE PLANS AND BUILDING SITE. CLAIMS MADE SUBSEQUENT TO THE PROPOSAL FOR MATERIALS AND LABOR, DUE TO DIFFICULTIES ENCOUNTERED, WILL NOT BE RECOGNIZED IF THEY COULD HAVE BEEN FORESEEN WITH PROPER EXAMINATION OF THE PROJECT. CONDUCTORS OPERATING AT 50 VOLTS OR GREATER SHALL BE IN RACEWAY. RACEWAY WITHIN THE STRUCTURE AND ABOVE THE FLOOR SLAB SHALL BE METAL (EMT UNLESS OTHERWISE NOTED). RACEWAY BELOW THE FLOOR SLAB AND UNDERGROUND RACEWAY OUTSIDE THE STRUCTURE SHALL BE (SCHED 40) PVC.

ALL EXTERIOR JUNCTION BOXES, EQUIPMENT AND DEVICES SHALL BE WEATHERPROOF LOW VOLTAGE CABLES OR CONDUCTORS OPERATING AT LESS THAN 50 VOLTS SHALL BE INSTALLED WITHIN EMT, WHERE INSTALLED WITHIN WALLS OR INACCESSIBLE SPACES, UNLESS OTHERWISE NOTED. LOW VOLTAGE CABLES MAY BE RUN IN CABLE TRAY WHERE INDICATED. LOW VOLTAGE CABLES MAY BE RUN IN CABLE SUPPORT HOOKS ABOVE ACCESSIBLE CEILINGS WHERE INDICATED. LOW VOLTAGE CABLE SHALL BE PLENUM RATED. IN PLENUM

IMPLEMENT A COORDINATED EFFORT BETWEEN THE ARCHITECTURAL SHEETS AND THE ELECTRICAL SHEETS REGARDING THE EXACT LOCATION OF DEVICES. ARCHITECTURAL ELEVATIONS AND ARCHITECTURAL DETAILS TAKE PRECEDENCE OVER LOCATIONS SHOWN ON ELECTRICAL SHEETS. REFER TO MECHANICAL SHEETS FOR SPECIFIED FACTORY INSTALLED DISCONNECTS. ALL EQUIPMENT SHALL HAVE A DISCONNECT SWITCH AT EACH PIECE OF EQUIPMENT. THE ELECTRICAL CONTRACTOR SHALL FURNISH FUSED

DISCONNECTS AS REQUIRED BY N.E.C. WHETHER, OR NOT, SHOWN ON ELECTRICAL PLANS.

PROVIDE MC CABLE OR RACEWAY AND CONDUCTORS AS REQUIRED TO ACHIEVE CIRCUITING SHOWN. SIZE CONDUCTORS PER MAXIMUM OVERCURRENT PROTECTION AMPACITY AND CONDUCTOR FILL CRITERIA. PROVIDE DEDICATED NEUTRAL AND DEDICATED GROUND CONDUCTOR FOR EACH CIRCUIT. INCREASE BRANCH CIRCUIT CONDUCTOR SIZE AND RACEWAY SIZE FOR A MAXIMUM OF 3% VOLTAGE DROP. INCREASE FEEDER CIRCUIT CONDUCTOR SIZE AND RACEWAY SIZE FOR A MAXIMUM OF 2% VOLTAGE DROP. THE NEUTRAL CONDUCTOR SHALL BE THE SAME SIZE AS THE PHASE CONDUCTOR, UNLESS OTHERWISE NOTED. INCREASE THE GROUND CONDUCTOR SIZE PROPORTIONALLY AS INDICATED BY THE N.E.C. 11. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO CONFIRM THE N.E.C. REQUIRED CLEARANCES FOR ALL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS PRIOR TO INSTALLATION. ADVISE THE APPROPRIATE TRADE SHOULD THE CLEARANCES BE DEFICIENT. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO CONFIRM THE N.E.C. REQUIRED CLEARANCES FOR ALL ELECTRICAL EQUIPMENT PRIOR TO INSTALLATION. THE ELECTRICAL CONTRACTOR SHALL INSTALL ALL ELECTRICAL EQUIPMENT WHILE MAINTAINING THE N.E.C. REQUIRED CLEARANCES. IMPLEMENT A COORDINATED EFFORT WITH OTHER TRADES FOR THE PROPER INSTALLATION OF ALL EQUIPMENT.

CONSULT THE CONSTRUCTION DOCUMENTS, OF ALL TRADES, MANUFACTURER'S INSTALLATION MANUALS, ETC. ALL SPATIAL CONFLICTS SHALL BE RESOLVED PRIOR TO INSTALLING RACEWAYS AND BOXES, AT NO ADDITIONAL COST TO SANITARY PIPING, CONDENSATE PIPING AND OTHER PIPING REQUIRED TO BE SLOPED.

REFRIGERANT PIPING RACEWAYS 3" AND LARGER

INSTALLED IN OFFICE FURNITURE

ANY COSTS INCURRED DUE TO OBVIOUS LACK OF COOPERATION AND/OR OBVIOUS LACK OF COORDINATION, AMONG THE TRADES, SHALL BE BORNE BY THE CONTRACTOR. MAINTAIN A CLEAN SITE. REMOVE: DIRT, DEBRIS, EMPTY CARTONS, TOOLS, RACEWAY, WIRE SCRAPS, MISCELLANEOUS SPARE EQUIPMENT AND MATERIALS USED IN THIS DIVISION OF THE WORK DURING CONSTRUCTION AT THE END OF EVERY WORKDAY. NEW COMPONENTS SHALL BE MAINTAINED FREE OF DUST, GRIT, FOREIGN MATERIALS AND LEFT AS NEW BEFORE THE APPROVAL OF THE WORK.

ALL THE SYMBOLS AND ABBREVIATIONS SHOWN, WITHIN THE ELECTRICAL SHEETS, MAY OR MAY NOT BE USED IN THIS SET OF DRAWINGS. WORK SHALL COMPLY WITH THE LATEST PUBLISHED STANDARD PRACTICES FOR GOOD WORKMANSHIP PUBLISHED BY THE NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA). COMPLY WITH THE: N.E.C., WV STATE CODE, WV STATE FIRE CODE, LOCAL CODES AND ORDINANCES WITH THEIR AMENDMENTS. CONNECTION REQUIREMENTS, CONTROL CONDUCTORS, SHALL BE CONFIRMED, PRIOR TO INSTALLING BOXES OR THE SUPPLIED EQUIPMENT CONNECTION, THE MAXIMUM OVERCURRENT PROTECTION, AND THE CONDUCTOR SIZE

CONTRACTOR SHALL INSTALL THE CONFIRMED CONDUCTORS AND OVERCURRENT PROTECTION BASED ON THE MAXIMUM OVERCURRENT PROTECTION AND DISTANCE FROM THE SOURCE SWITCHBOARD/PANELBOARD TO THE EQUIPMENT. THE ELECTRICAL CONTRACTOR SHALL NOT RECEIVE A CHANGE ORDER SHOULD THE SUPPLIED EQUIPMENT ELECTRICAL CONNECTIONS BE DIFFERENT THAN THE BASIS OF DESIGN. THE ELECTRICAL WORK SHALL BE PERFORMED UNDER THE SUPERVISION OF A LICENSED MASTER ELECTRICIAN, LICENSED IN THE LOCAL OF THE PROJECT. THE ELECTRICAL CONTRACTOR SHALL PROCURE THE REQUIRED PERMITS, INSPECTIONS, LICENSES AND PAY ALL SUCH FEES ASSOCIATED WITH THIS WORK. ALL MATERIALS AND EQUIPMENT FURNISHED FOR THIS PROJECT SHALL BE NEW, UNUSED, COMMERCIAL GRADE, FREE OF DEFECTS, LISTED AND LABELED BY A NATIONALLY RECOGNIZED TESTING LABORATORY UNLESS OTHERWISE NOTED. THE SAID MATERIALS AND EQUIPMENT SHALL BE STAMPED AS SUCH. ALL MATERIALS AND EQUIPMENT SHALL BE INSTALLED UTILIZING THE MANUFACTURER'S WRITTEN INSTRUCTIONS. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR MAKING FINAL CONDUCTOR TERMINATIONS TO WIRING DEVICES

SHALL BE CONFIRMED PRIOR TO RACEWAY AND CONTROL CONDUCTOR INSTALLATION. THE ELECTRICAL

THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR CONDUCTORS AND INSTALLING VOICE/DATA DEVICES WITHIN OFFICE FURNITURE. IMPLEMENT A COORDINATED LOCATION OF DEVICES WITH FURNITURE LAY-OUT, AS REQUIRED THE VOICE/DATA CABLE SHALL BE INSTALLED FROM THE OWNER DESIGNATED LOCATION TO THE COORDINATED THE SECURITY SYSTEM DEVICES ARE SHOWN FOR THE LOCATION OF BOX LOCATIONS ONLY. THE SECURITY SYSTEM HARDWARE AND CABLES SHALL BE PROVIDED UNDER SEPARATE CONTRACT. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO PROVIDE RACEWAY PROVISIONS. BACK BOXES. ROUGH-INS. SLEEVES AND POWER TO HEAD END EQUIPMENT FOR EXACT REQUIREMENTS PRIOR TO START OF WORK.

RACEWAY SHALL NOT BE INSTALLED BELOW FLOOR SLAB UNLESS INDICATED OTHERWISE. FURNISH AND INSTALL RACEWAY FROM BOXES, FOR THE FOLLOWING DEVICES, INTO THE ACCESSIBLE CEILING SPACE IN THE CORRIDOR, UNLESS NOTED OTHERWISE:

1/2"C TV OUTLETS 1/2"C DOOR SECURITY DEVICES (CARD READERS, DOOR STRIKES ETC.) 3/4"C TELEPHONE OUTLETS

3/4"C OTHER SYSTEMS INDICATED IN CONSTRUCTION DOCUMENTS THE ELECTRICAL CONTRACTOR SHALL INSTALL RACEWAY, CONDUCTORS AND MAKE TERMINATIONS AS REQUIRED TO FIRE ALARM DEVICES AND EQUIPMENT IDENTIFIED ON THE PLUMBING SHEETS. THE MECHANICAL SHEETS AND THE FIRE PROTECTION SHEETS. MAKES IDENTIFIED WITHIN THE SCHEDULES ARE ILLUSTRATED AS A BASIS OF DESIGN AND ESTABLISH A LEVEL OF QUALITY REQUIRED. AN EQUAL PRODUCT SHALL BE CONSIDERED, FOLLOW THE PROCEDURE INDICATED WITHIN THE SPECIFICATIONS CONCERNING SUBSTITUTIONS PRIOR TO THE BID. SWITCHBOARDS AND PANELBOARDS SHALL CONTAIN A TYPEWRITTEN DIRECTORY WITH A PLASTIC COVER AFFIXED TO THE INSIDE DOOR, UNLESS OTHERWISE NOTED. THE TYPEWRITTEN DIRECTORY SHALL INDICATE THE FINAL TERMINATIONS FOR EACH CIRCUIT BREAKER PROTECTING THE EQUIPMENT AND RESPECTIVE CONDUCTORS AFTER THE LOAD BALANCING IS COMPLETED.

EACH CONDUCTOR SHALL BE MARKED IDENTIFYING THE PANELBOARD/SWITCHBOARD AND THE SPACE NUMBER AFTER THE LOAD BALANCING HAS BEEN COMPLETED. ANY DEVIATION FROM PLANS WITHOUT PRIOR APPROVAL OF THE ENGINEER SHALL BE CAUSE FOR THE REJECTION OF MATERIALS AND/OR WORKMANSHIP, AT THE DISCRETION OF THE ENGINEER. ANY COST INCURRED TO CORRECT SUCH DEVIATION, TO THE SATISFACTION OF THE ENGINEER OR OWNER, SHALL BE BORNE BY THE CONTRACTOR. ALL RACEWAYS (RIGID AND FLEXIBLE) SHALL BE PROPERLY SECURED TO THE BUILDING STRUCTURE. DUCT

SUPPORTS, PIPING SUPPORTS, ETC. SHALL NOT BE CONSIDERED AN ACCEPTABLE SUPPORT. STARTERS AND DISCONNECTS, NOT FACTORY INSTALLED, SHALL BE INSTALLED BY THE ELECTRICAL CONTRACTOR. THE ELECTRICAL CONTRACTOR SHALL MOUNT ALL STARTERS, DISCONNECTS AND FURNISH SUPPORTING STRUCTURES AS REQUIRED. MOTOR OVERLOAD PROTECTION UNITS SHALL BE INSTALLED WITHIN THE STARTERS AS THE NAME PLATE DATA ON THE EQUIPMENT REQUIRES. THE INSTALLATION OF THE TEMPERATURE CONTROL RACEWAY AND CONDUCTORS SHALL BE THE RESPONSIBILITY OF THE CONTROL CONTRACTOR, UNLESS OTHERWISE NOTED.

THE CONTROLS CONTRACTOR SHALL ENGAGE AN ELECTRICAL CONTRACTOR TO PROVIDE ALL RACEWAY, POWER CONDUCTORS, BOXES, ETC. REQUIRED FOR THE AUTOMATIC TEMPERATURE CONTROL SYSTEM TO BE FULLY OPERATIONAL. POWER CONDUCTORS ASSOCIATED WITH THE AUTOMATIC TEMPERATURE CONTROL SYSTEM INDICATED ON THE ELECTRICAL DRAWINGS IS CONSIDERED PART OF THE ELECTRICAL CONTRACTOR'S SCOPE OF WORK AND SHALL BE INCLUDED IN THE ELECTRICAL CONTRACTOR'S PROPOSAL. ALL COSTS FOR CONDUCTORS AND RACEWAY REQUIRED, TO ACCOMPLISH THE INTENT OF THE SEQUENCE OF OPERATIONS AND COMPLY WITH THE CONTROLS SPECIFICATION, SHALL BE INCLUDED AS PART OF THE CONTROL CONTRACTOR'S PROPOSAL. MINIMUM CONDUCTOR SIZE SHALL BE #12 AWG AND MINIMUM RACEWAY SIZE SHALL BE 3/4".ALL CONDUCTORS SHALL BE RUN IN RACEWAY UNLESS OTHERWISE NOTED. THE INSTALLATION OF MC CABLE IS ONLY APPROVED FOR THIS PROJECT FOR USE ON LUMINAIRE WHIPS AT A MAXIMUM OF 6'-0" LENGTH.

MATERIALS, EQUIPMENT, ASSEMBLIES AND SYSTEMS SHALL MEET ALL PERTINENT REQUIREMENTS OF NATIONALLY RECOGNIZED TESTING ORGANIZATIONS SUCH AS UL, NSF, ASTM, ASSE, AWWA, AGA AND NFPA AS WELL AS THE ICC, AND LOCAL AMENDMENTS. ALL INSTALLED SYSTEMS, DEVICES AND RELATED ITEMS SHALL BE TESTED IN PLACE. ALL DEFECTIVE SYSTEMS,

DEVICES AND RELATED ITEMS SHALL BE REPLACED, PRIOR TO THE ISSUANCE OF SUBSTANTIAL COMPLETION. WHERE JOB CONDITIONS REQUIRE CHANGES FROM THE CONTRACT DOCUMENTS, THAT DO NOT CHANGE THE SCOPE OR NATURE OF THE WORK REQUIRED, THE CONTRACTOR SHALL MAKE CHANGES WITHOUT ADDITIONAL COST TO THE OWNER. NO OTHER CHANGES MAY BE MADE WITHOUT WRITTEN PERMISSION OF THE ENGINEER OR OWNER. THE ELECTRICAL CONTRACTOR SHALL INCLUDE THE COST FOR PREMIUM SHIPPING, AS REQUIRED, TO MAINTAIN THE ESTABLISHED CONSTRUCTION SCHEDULE CONTRACTOR SHALL MARK WITH PERMANENT MARKER THE CIRCUIT NUMBER AND PANEL NAME ON THE BACK SIDE OF ALL JUNCTION BOXES, SWITCH AND RECEPTACLE COVERS. MARK ALL CONDUCTORS ON THE LOAD SIDE WITHIN EACH JUNCTION BOX AND ALL LOAD SIDE TERMINALS. THE CONDUCTORS SHALL DISPLAY THE PANELBOARD NAME AND THE CIRCUIT NUMBER WHERE THE CONDUCTORS ARE TERMINATED.

REFER TO ARCHITECTURAL/STRUCTURAL DRAWINGS FOR SEISMIC REQUIREMENTS. ALL INSTALLATIONS SHALL COMPLY WITH THE SEISMIC REQUIREMENTS ILLUSTRATED ON THE ARCHITECTURAL/ STRUCTURAL SHEETS. THE MATERIALS AND METHODS UTILIZED FOR PROPER SEISMIC RESTRAINT SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID. THERE WILL NOT BE AN ADDITIONAL COST TO THE OWNER FOR COMPLYING WITH A PROPER INSTALLATION. IF ANY CONFLICT IN VOLTAGE. PHASE. OR LOAD IS ENCOUNTERED WHICH WOULD ALTER THE CIRCUIT SIZE. THIS CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY. FAILURE TO DO SO SHALL PLACE THE RESPONSIBILITY FOR ANY SUBSEQUENT CIRCUIT CHANGE DIRECTLY UPON THE CONTRACTOR. ALL ITEMS REQUIRED TO BE REMOVED OR RELOCATED FOR INSTALLATION OF NEW WORK MAY NOT BE INDICATED ON THESE SHEETS. THE CONTRACTOR SHALL FIELD VERIFY THE LOCATIONS OF ALL EXISTING DEVICES AND EQUIPMENT REQUIRED TO BE REMOVED OR RELOCATED, PRIOR TO BIDDING. THE COST TO CONFORM TO THE EXISTING

CONDITIONS SHALL BE INCLUDED WITHIN THE BASE BID. REFER TO ARCHITECTURAL SHEETS FOR FIRE RATINGS ON WALLS. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR DISCONNECTING POWER TO ALL EXISTING EQUIPMENT THAT IS BEING REMOVED ON THIS PROJECT. THE ELECTRICAL CONTRACTOR SHALL REVIEW ALL OTHER PROJECT SHEETS TO IDENTIFY DEMOLITION OF EXISTING EQUIPMENT AND COOPERATE CLOSELY WITH OTHER TRADES. AT THE CONTRACTOR'S DISCRETION CONDUCTORS AND RACEWAYS MAY BE REUSED IF ADEQUATELY SIZED AND LOCATED FOR NEW EQUIPMENT CONNECTIONS, UNLESS OTHERWISE NOTED. RACEWAY MAY BE EXTENDED TO NEW

EQUIPMENT LOCATIONS AND CONDUCTORS MAY BE PROPERLY SPLICED (PER NEC) AND EXTENDED FOR TERMINATION AFTER FIELD INVESTIGATION, IF IT IS DETERMINED BY THE ENGINEER AND THE ELECTRICAL CONTRACTOR, THAT THE EXISTING CONDUCTORS WIRE AND RACEWAY CANNOT BE UTILIZED FOR NEW WORK. THE ELECTRICAL CONTRACTOR SHALL REMOVE ALL CONDUCTORS AND RACEWAY BACK TO THE SOURCE. RACEWAY IN CMU OR CONCRETE WALLS MAY BE ABANDONED IN PLACE UNLESS IN CONFLICT WITH NEW WORK. THE CONDUCTORS WITHIN ABANDONED

RACEWAY SHALL BE REMOVED. THE ELECTRICAL CONTRACTOR SHALL FURNISH DUCT MOUNTED SMOKE DETECTORS COMPATIBLE WITH THE EXISTING FIRE ALARM SYSTEM FOR INSTALLATION BY THE AUTOMATIC TEMPERATURE CONTROLS FIRE ALARM CONTRACTOR REMOTE TEST STATION(S), RELAY MODULES AND CONDUCTORS TO THE FIRE ALARM CONTROL PANEL, SHALL BE INCLUDED WITHIN THE PROPOSED BASE BID, FOR A COMPLETE AND OPERATIONAL SYSTEM. IMPLEMENT A COORDINATED EFFORT FOR INSTALLING FIRE ALARM REMOTE TEST STATIONS. CONFIRM WITH THE OWNER, FOR THE LOCATION OF THE TEST STATIONS, PRIOR TO INSTALLATION. REFER TO MECHANICAL CONTROL SHEET(S) FOR REQUIRED DUCT SMOKE DETECTORS.

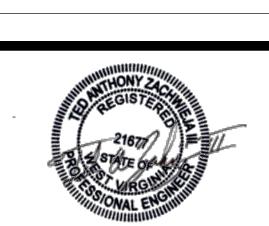
HARDWARE, RACEWAY AND CONDUCTORS SHALL BE INSTALLED SO THE NEW FIRE ALARM NOTIFICATIONS DEVICES SHALL BE IN PHASE WITH THE EXISTING NOTIFICATION DEVICES. INSTALL ADDITIONAL CAPACITY OF THE SECONDARY POWER SOURCE TO SATISFY THE LOAD OF THE NEW NOTIFICATION DEVICES.

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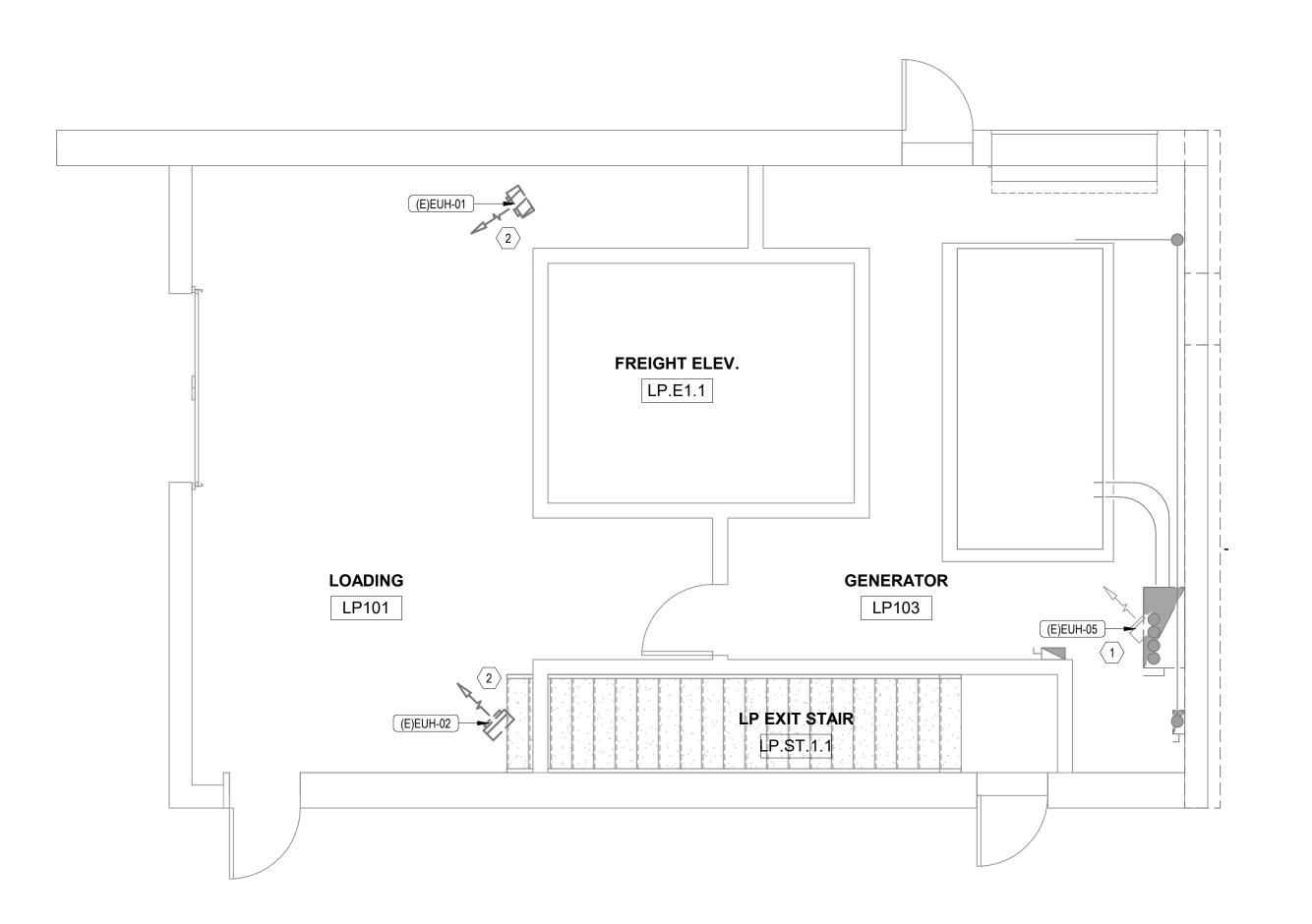
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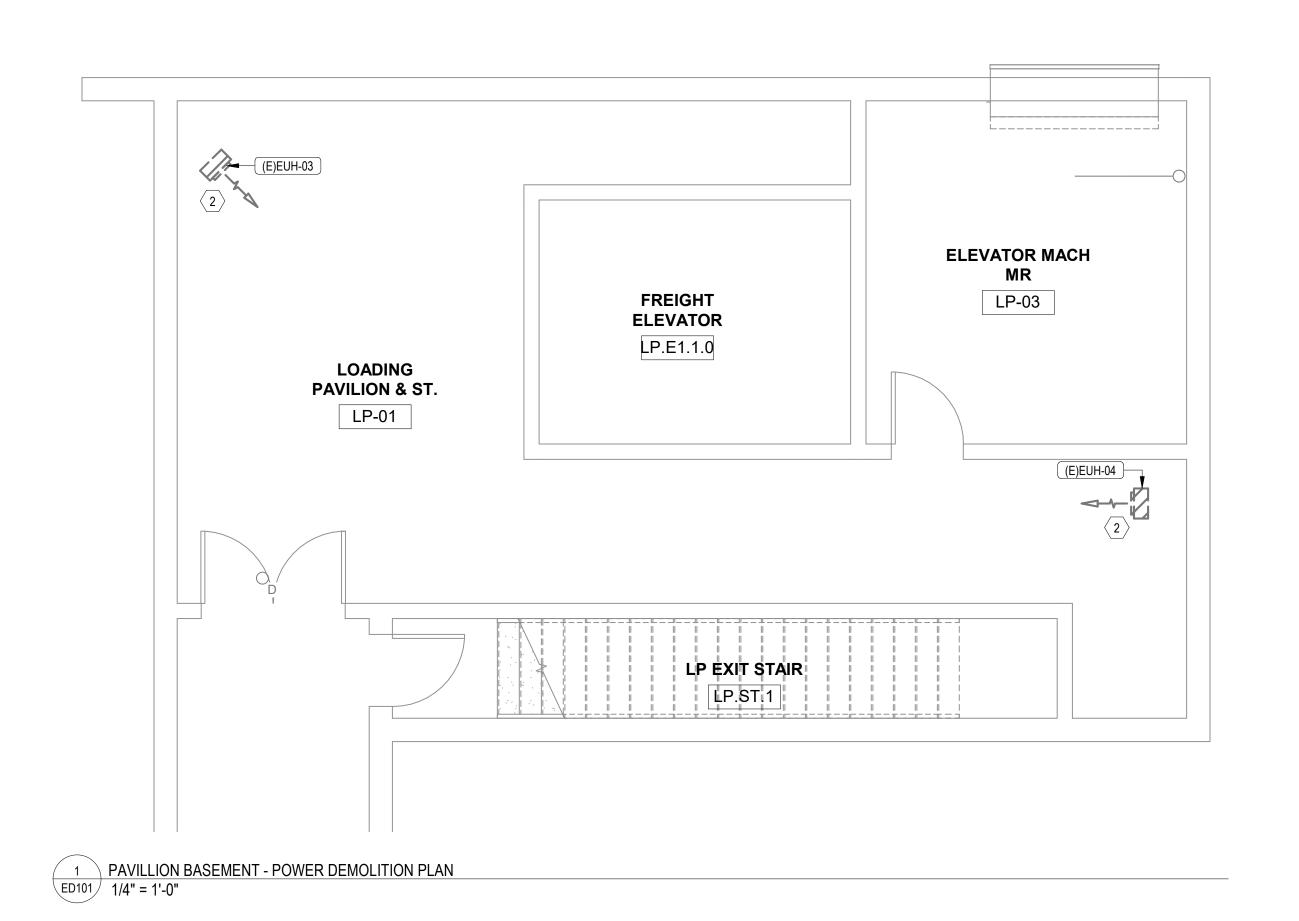
DRAWING TITLE: ELECTRICAL SYMBOLS AND ABBREVIATIONS

DRAWN BY: MM CHECKED BY:TZ3 PROJ. NO: GSD-221-0 DRAWING NO:



PAVILION FIRST FLOOR - POWER DEMOLITION PLAN

1/4" = 1'-0"



General Notes - Demolition

1 SEE ARCHITECTURAL DRAWINGS AND SPECIFICATIONS FOR PHASES OF DEMOLITION AND CONSTRUCTION. COORDINATE WITH GENERAL CONSTRUCTION.

DISCONNECT AND REMOVE ALL ELECTRICAL DEVICES AND LIGHTING FIXTURES IN DEMOLITION AREAS UNLESS NOTED OTHERWISE.
 DISCONNECT AND REMOVE ALL ELECTRICAL DEVICES IN WALLS TO BE DEMOLISHED. WALLS TO BE DEMOLISHED ARE SHOWN DASHED. DISCONNECT AND REMOVE ASSOCIATED CONDUIT AND WIRE BACK TO LAST REMAINING DEVICE. FURNISH AND INSTALL CONDUIT AND WIRE AS NECESSARY FOR CONTINUITY OF CIRCUIT(S) TO ANY EXISTING DEVICES TO REMAIN. COORDINATE AND VERIFY REQUIREMENTS WITH NEW WORK IN AREA.

4 FURNISH AND INSTALL CONDUIT AND WIRE AS NECESSARY FOR CONTINUITY OF ANY FEEDERS OR BRANCH CIRCUITS ORIGINATING OUTSIDE THE DEMOLITION AREA THAT SERVES ANY ELECTRICAL EQUIPMENT OR DEVICES TO REMAIN AFTER DEMOLITION. MODIFY OR REPLACE AS REQUIRED.

5 FURNISH AND INSTALL CONDUIT AND/OR COMMUNICATIONS/DATA WIRING AS NECESSARY FOR CONTINUITY OF ANY WIRING ORIGINATING OUTSIDE THE DEMOLITION AREA THAT SERVES ANY COMMUNICATIONS/DATA EQUIPMENT OR DEVICES TO REMAIN AFTER DEMOLITION. MODIFY OR REPLACE AS REQUIRED.
6 DISCONNECT AND REMOVE LIGHT SWITCHES IN DEMOLITION AREAS AS

NECESSARY TO ACCOMMODATE NEW DOOR CONFIGURATIONS.

7 DISCONNECT AND REMOVE ANY EXISTING ELECTRICAL DEVICES AND BACK BOXES AS NECESSARY WHERE NEW WALL CONSTRUCTION WILL INTERSECT AN EXISTING WALL. FURNISH AND INSTALL CONDUIT AND WIRE AS REQUIRED FOR CONTINUITY OF CIRCUIT(S).

9 FURNISH AND INSTALL BLANK COVER PLATES OVER ALL EXISTING UNUSED OPENINGS.

KEYNOTES

1 EXISTING SUSPENDED ELECTRIC UNIT HEATER TO REMAIN.
2 EXISTING UNIT HEATER WILL BE REPLACED. REFER TO E401 FOR NEW

2 EXISTING UNIT HEATER W UNIT HEATER DETAILS. 135 Corporate Center Drive Scott Depot, WV 25560

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PROJECT NAME:
Building #3 Hydronic Boiler System
Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

PAVILION ELECTRICAL DEMOLITION

FILE: XXX
DRAWN BY: MM
CHECKED BY:TZ3
PROJ. NO: GSD-221-C
DRAWING NO:

ED101

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### GENERAL NOTES - POWER

- 1 WHERE CONNECTED TO A 20A. BRANCH CIRCUIT SUPPLYING AN INDIVIDUAL RECEPTACLE (SIMPLEX OR DUPLEX), THE RECEPTACLE
- SHALL BE RATED AT 20A.

  2 PROVIDE HOUSEKEEPING PADS FOR ALL FLOOR MOUNTED AND GRADE MOUNTED ELECTRICAL EQUIPMENT. MINIMUM REQUIREMENTS: 4" HIGH, 4% AIR ENTRAINED, POLYFIBER REINFORCED CONCRETE, 4" WIDER AND 4" LONGER THAN EQUIPMENT TO BE PLACED ON IT. REFER TO ELECTRICAL DETAIL DRAWINGS FOR TRANSFORMER, GENERATOR, OR SWITCHGEAR PADS THAT MAY EXCEED THESE REQUIREMENTS.
- SWITCHGEAR PADS THAT MAY EXCEED THESE REQUIREMENTS.

  REFER TO SECTION 26 0519 FOR MINIMUM CONDUCTOR SIZE ADJUSTMENTS FOR VOLTAGE DROP.
- WIRE COUNTS FOR CIRCUIT CONDUCTORS ARE NOT SHOWN. PROVIDE PROPER NUMBER OF CONDUCTORS TO ACHIEVE CIRCUIT AND SWITCHING CONNECTIONS SHOWN.
   MODIFICATIONS TO NUMBER OF CONDUCTORS IN HOME RUNS IN
- 5 MODIFICATIONS TO NUMBER OF CONDUCTORS IN HOME RUNS IN
  ADDITION TO CIRCUITS INDICATED ON THIS DRAWING ARE PROHIBITED.
  6 CIRCUIT NUMBERS AT DEVICES CORRESPOND TO PANELBOARD
  BREAKERS (SEE PANELBOARD SCHEDULE). BRANCH CIRCUITS SHALL
  BE SIZED ACCORDING TO THE CIRCUIT BREAKER RATING, UNLESS
- INDICATED OTHERWISE ON THE ELECTRICAL EQUIPMENT SCHEDULE.

  7 HARDWARE, RACEWAY AND CONDUCTORS SHALL BE INSTALLED SO
  THE NEW FIRE ALARM NOTIFICATIONS DEVICES SHALL BE IN PHASE
  WITH THE EXISTING NOTIFICATION DEVICES. INSTALL ADDITIONAL
  CAPACITY OF THE SECONDARY POWER SOURCE TO SATISFY THE LOAD
  OF THE NEW NOTIFICATION DEVICES.

### KEYNOTES

- 1 EC SHALL PROVIDE A NEW 80A CIRCUIT BREAKER IN THE "LBMNE" PANEL TO FEED THE NEW PAD MOUNTED XFMR IN THE GENERATOR ROOM
- CONDUIT RISE TO FIRST LEVEL TO FEED PAD MOUNTED XFMR THROUGH DISCONNECT. REFER SHEET E401.
   EC MAY REUSE EXISTING CONDUIT AND WIRING. EC SHALL REPLACE THE EXISTING 208V 1PH CIRCUIT BREAKER (37,39) IN THE PANEL LBPP TO A 120V 1PH 15A CIRCUIT BREAKER TO USE THE EXISTING WIRING. CONTRACTOR SHALL INSTALL A NEW 20A BREAKER IN THE UNUSED SPACE AND RELABEL IT AS SPARE AND KEEP THE BREAKER IN THE OFF
- POSITION.

  4 EC SHALL PROVIDE 3#4, 1#8G, CIRCUIT WIRING IN A 1-1/4" CONDUIT FROM A NEW 80A 3P BREAKER IN "HBMNE" IN 480V SWITCH GEAR RM TO THE 3P 80A NFS DISCONNECT SERVING THE 45KVA XFMR LOCATED IN THE GENERATOR ROOM IN LEVEL-1.
- 5 E.C. SHALL BE RESPONSIBLE FOR LINE VOLTAGE WIRING BETWEEN
  THERMOSTAT AND UNIT HEATER. REFER TO MP SHEETS FOR ADDITIONAL
  INFORMATION AND COORDINATE REQUIREMENTS WITH CONTROLS'
  CONTRACTOR.

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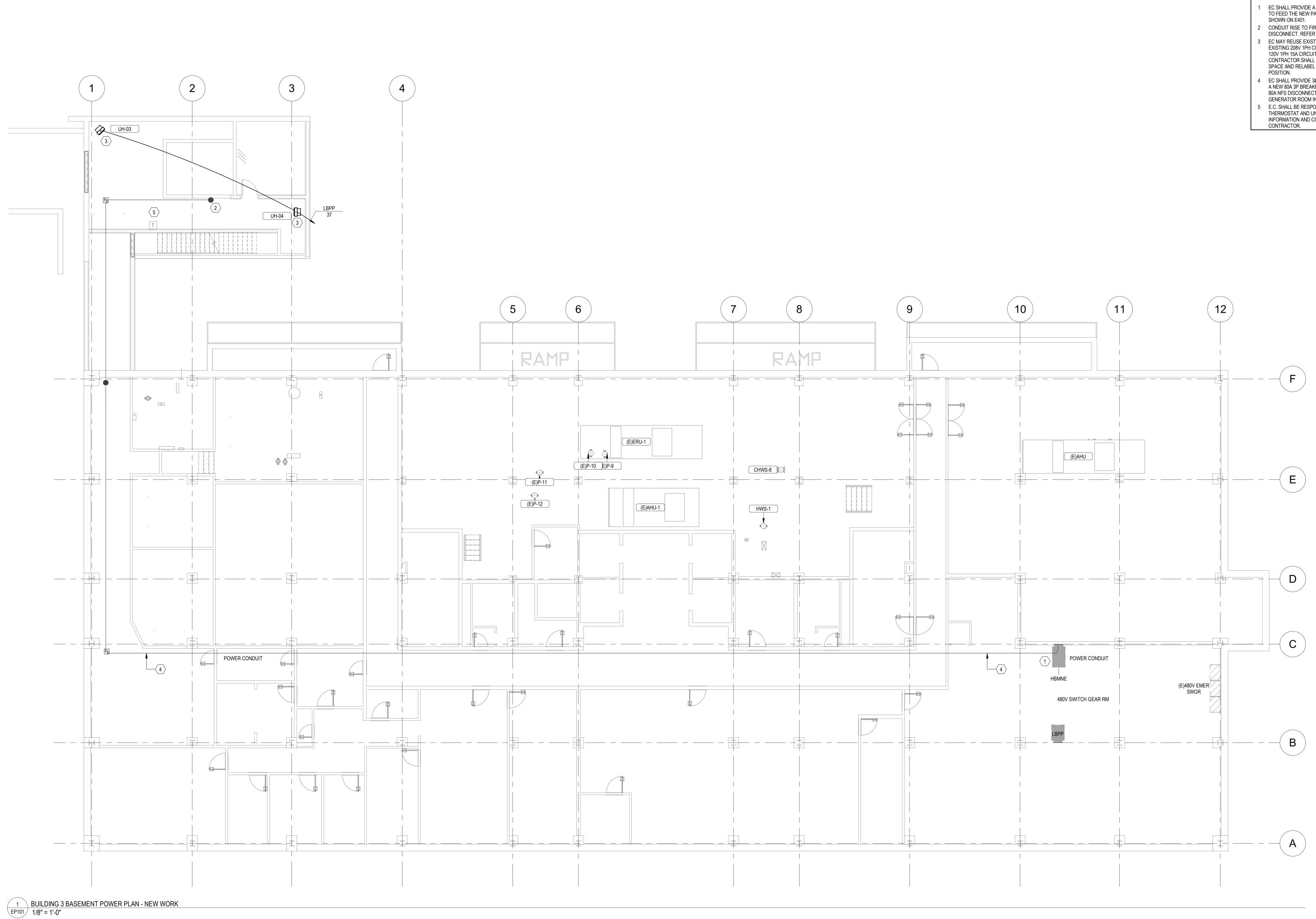
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DRAWING TITLE:

NEW POWER PLANS

FILE: XXX
DRAWN BY: MM
CHECKED BY:TZ3
PROJ. NO: GSD-221-C
DRAWING NO:

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### GENERAL NO

A. CONTRACTOR SHALL REFER TO SPECIFICATIONS REGARDING PROVIDING ADDITIONAL SPARE LAMPS, LENSES, AND GLOBES.

B. WHERE "APPROVED EQUAL" IS LISTED IN THE MANUFACTURER COLUMN, FIXTURES MUST BE SUBMITTED AS A SUBSTITUTION FOR APPROVAL PRIOR TO BID SUBMISSION.

## SCHEDULE NOTES: 1. NO SUBSTITUTIONS PERMITTED.

2. ADJUST OPTICS FOR WIDE DISTRIBUTION.

### GENERAL NOTES - LIGHTING

- ALL MOUNTING HEIGHTS FOR LIGHTING FIXTURES ARE TO THE BOTTOM OF THE FIXTURES UNLESS INDICATED OTHERWISE.
- OF THE FIXTURES UNLESS INDICATED OTHERWISE.

  SEE ARCHITECTURAL EXTERIOR ELEVATIONS FOR MOUNTING HEIGHTS
  OF EXTERIOR LIGHTING FIXTURES.
- 3 REFER TO SECTION 26 0519 FOR MINIMUM CONDUCTOR SIZE ADJUSTMENTS FOR VOLTAGE DROP.
- WIRE COUNTS FOR CIRCUIT CONDUCTORS ARE NOT SHOWN. PROVIDE PROPER NUMBER OF CONDUCTORS TO ACHIEVE CIRCUIT AND SWITCHING CONNECTIONS SHOWN.
- MODIFICATIONS TO NUMBER OF CONDUCTORS IN HOME RUNS IN ADDITION TO CIRCUITS INDICATED ON THIS DRAWING ARE PROHIBITED.

  CIRCUIT NUMBERS AT DEVICES CORRESPOND TO PANELBOARD BREAKERS (SEE PANELBOARD SCHEDULE). BRANCH CIRCUITS SHALL BE SIZED ACCORDING TO THE CIRCUIT BREAKER RATING, UNLESS INDICATED OTHERWISE ON THE ELECTRICAL EQUIPMENT SCHEDULE.

#### KEYNOTES

- 1 ALL LS-1 LIGHT FIXTURES MOUNTED ON WALL @9 FEET AFF.
   2 EC SHALL MOUNT THE LIGHT FIXTURE AT 8' HEIGHT TO TOP OF FIXTURE FROM FFL TO AVOID GLARE OUTSIDE THE FENCING AREA FOR THE FOOT
- 3 EC SHALL ADD A MANUAL SWITCH CONTROL (APART FROM PHOTOELECTRIC CELL CONTROL) TO MANUALLY CONTROL THE LIGHT FIXTURES LOCATED IN THE FENCED AREA. THE THIRD FIXTURE OVER THE DOOR SHALL NOT BE MANUALLY CONTROLLED BY THIS SWITCH.

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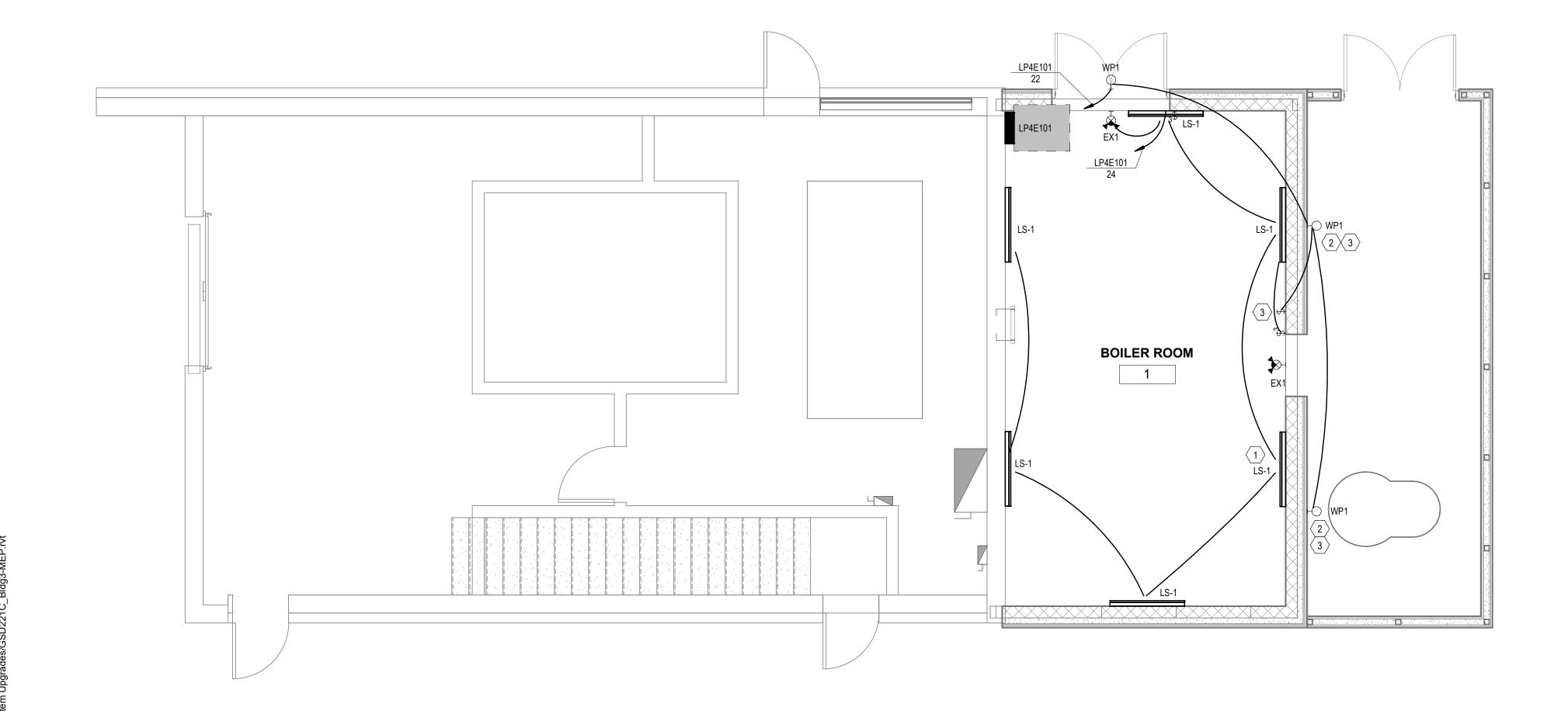
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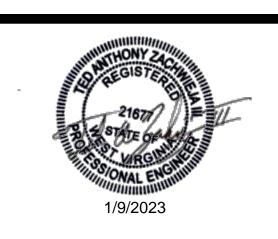
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DRAWING TITLE:
ELECTRICAL LIGHTING
PLAN

FILE: XXX
DRAWN BY: MM
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PROJ. NO: GSD-22

EL101

#### GENERAL NOTES - POWER

- WHERE CONNECTED TO A 20A. BRANCH CIRCUIT SUPPLYING AN INDIVIDUAL RECEPTACLE (SIMPLEX OR DUPLEX), THE RECEPTACLE
- SHALL BE RATED AT 20A. PROVIDE HOUSEKEEPING PADS FOR ALL FLOOR MOUNTED AND GRADE MOUNTED ELECTRICAL EQUIPMENT. MINIMUM REQUIREMENTS: 4" HIGH, 4% AIR ENTRAINED, POLYFIBER REINFORCED CONCRETE, 4" WIDER AND 4" LONGER THAN EQUIPMENT TO BE PLACED ON IT. REFER TO ELECTRICAL DETAIL DRAWINGS FOR TRANSFORMER, GENERATOR, OR
- SWITCHGEAR PADS THAT MAY EXCEED THESE REQUIREMENTS. REFER TO SECTION 26 0519 FOR MINIMUM CONDUCTOR SIZE ADJUSTMENTS FOR VOLTAGE DROP. WIRE COUNTS FOR CIRCUIT CONDUCTORS ARE NOT SHOWN. PROVIDE PROPER NUMBER OF CONDUCTORS TO ACHIEVE CIRCUIT AND
- SWITCHING CONNECTIONS SHOWN. MODIFICATIONS TO NUMBER OF CONDUCTORS IN HOME RUNS IN ADDITION TO CIRCUITS INDICATED ON THIS DRAWING ARE PROHIBITED.
- CIRCUIT NUMBERS AT DEVICES CORRESPOND TO PANELBOARD BREAKERS (SEE PANELBOARD SCHEDULE). BRANCH CIRCUITS SHALL BE SIZED ACCORDING TO THE CIRCUIT BREAKER RATING, UNLESS INDICATED OTHERWISE ON THE ELECTRICAL EQUIPMENT SCHEDULE. HARDWARE, RACEWAY AND CONDUCTORS SHALL BE INSTALLED SO THE NEW FIRE ALARM NOTIFICATIONS DEVICES SHALL BE IN PHASE WITH THE EXISTING NOTIFICATION DEVICES. INSTALL ADDITIONAL

### KEYNOTES

OF THE NEW NOTIFICATION DEVICES.

EC MAY REUSE EXISTING CONDUIT AND WIRING. EC SHALL REPLACE THE EXISTING 208V 1PH CIRCUIT BREAKER (85,87) IN THE PANEL 'L1PP' TO A 120V 1PH 15A CIRCUIT BREAKER TO USE THE EXISTING WIRING. CONTRACTOR SHALL INSTALL A NEW 20A BREAKER IN THE UNUSED SPACE AND RELABEL IT AS SPARE AND KEEP THE BREAKER IN THE OFF

CAPACITY OF THE SECONDARY POWER SOURCE TO SATISFY THE LOAD

- DISCONNECT SWITCH SERVED FROM NEW 80A/3P CIRCUIT BREAKER IN "HBMNE" AND CONNECTED TO THE PRIMARY SIDE OF THE FLOOR MOUNTED XFMR. REFER TO EP101.
- EC SHALL PROVIDE 4#2/0, 1#6G, CIRCUIT WIRING IN A 2" CONDUIT FROM SECONDARY OF NEW 45KVA XFMR LOCATED IN THE GENERATOR ROOM IN LEVEL-1 TO THE NEW 208V 150A LP4E101 PANEL LOCATED IN THE BOILER ROOM VIA THE DISCONNECT ON THE SECONDARY SIDE OF THE
- EMERGENCY SHUTOFF. REFER TO EMERGENCY NATURAL GAS APPLIANCE EMERGENCY SHUT DOWN CONTROL SCHEMATIC DETAIL ON M702 DRAWING FOR DETAILS.
- EC SHALL PROVIDE NECESSARY WIRING AND CONDUIT TO POWER UP THE KEYPAD AND CARD ACCESS. KEYPADS SHOULD MATCH THE EXISTING MODELS ON SITE SIMILAR TO SCHLAGE MODEL AD-400 SERIES FULL LOCKSET WHICH ARE INTEGRATED TO THE DOOR HANDLE. REFER TO ARCHITECTURAL DRAWINGS FOR KEYPAD DETAILS. 6 FURNISHED BY MC. EC SHALL BE RESPONSIBLE FOR LINE VOLTAGE
- WIRING BETWEEN THERMOSTAT AND UNIT HEATER. REFER TO MP SHEETS FOR ADDITIONAL INFORMATION AND COORDINATE REQUIREMENTS WITH MECHANICAL CONTRACTOR.
- EC SHALL INSTALL THE TRANSFORMER FURNISHED BY THE BOILER SUPPLIER FOR EACH OF THE BOILERS. EC SHALL PROVIDE A 4#12, #12G WIRING IN 3/4" CONDUIT ON PRIMARY SIDE OF TRANSFORMER FROM THE RESPECTIVE CIRCUIT BREAKER IN THE PANEL LP4E101 AND 4#12, #12G WIRING IN 3/4" CONDUIT FROM THE SECONDARY OF THE TRANSFORMER TO EACH BOILER DISCONNECT PROVIDED BY EC FOR EACH BOILER. B EC SHALL PROVIDE THE 4#12, #12G WIRING IN 3/4" CONDUIT BETWEEN THE DISCONNECTS TO THE RESPECTIVE BOILERS TO COMPLETE THE

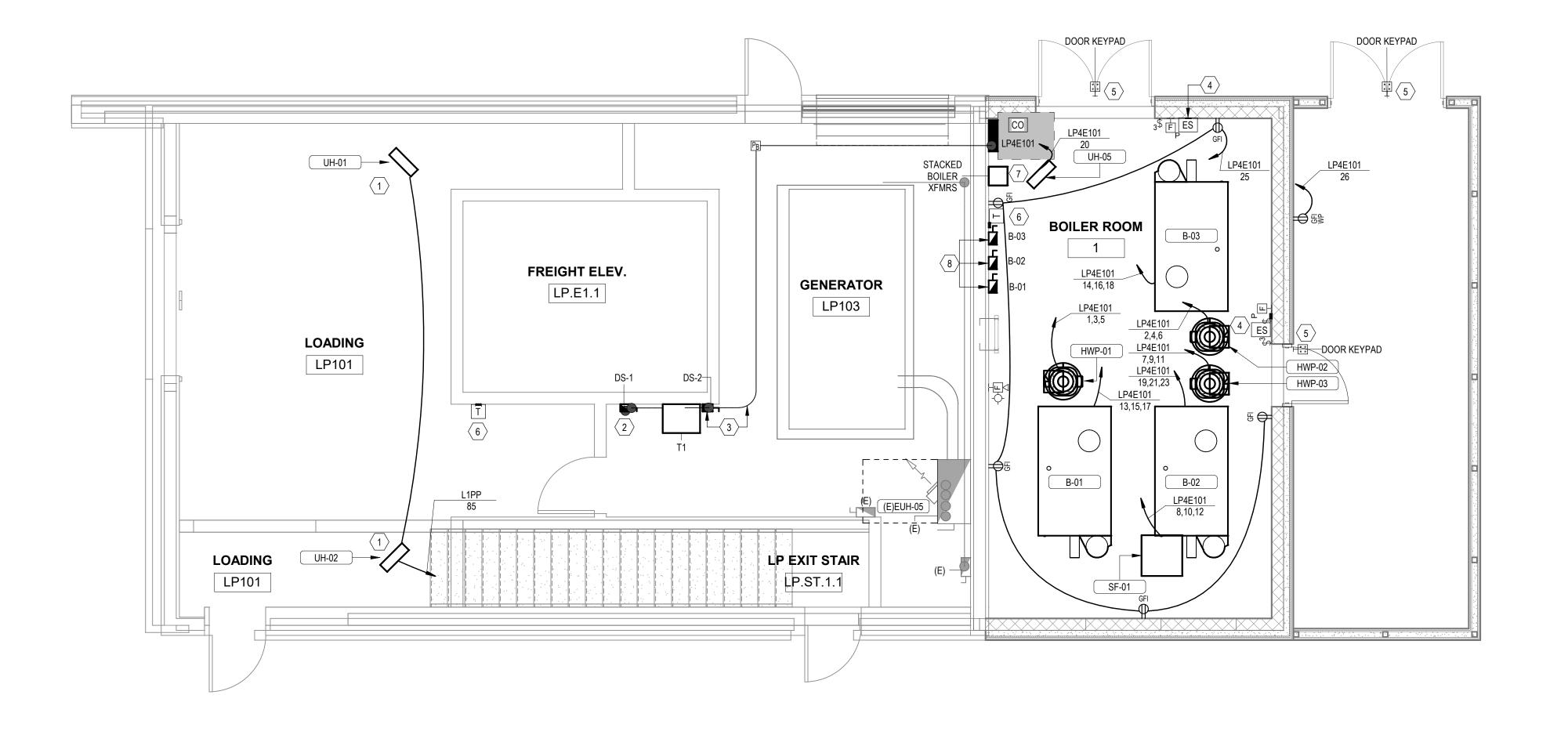
CIRCUIT.

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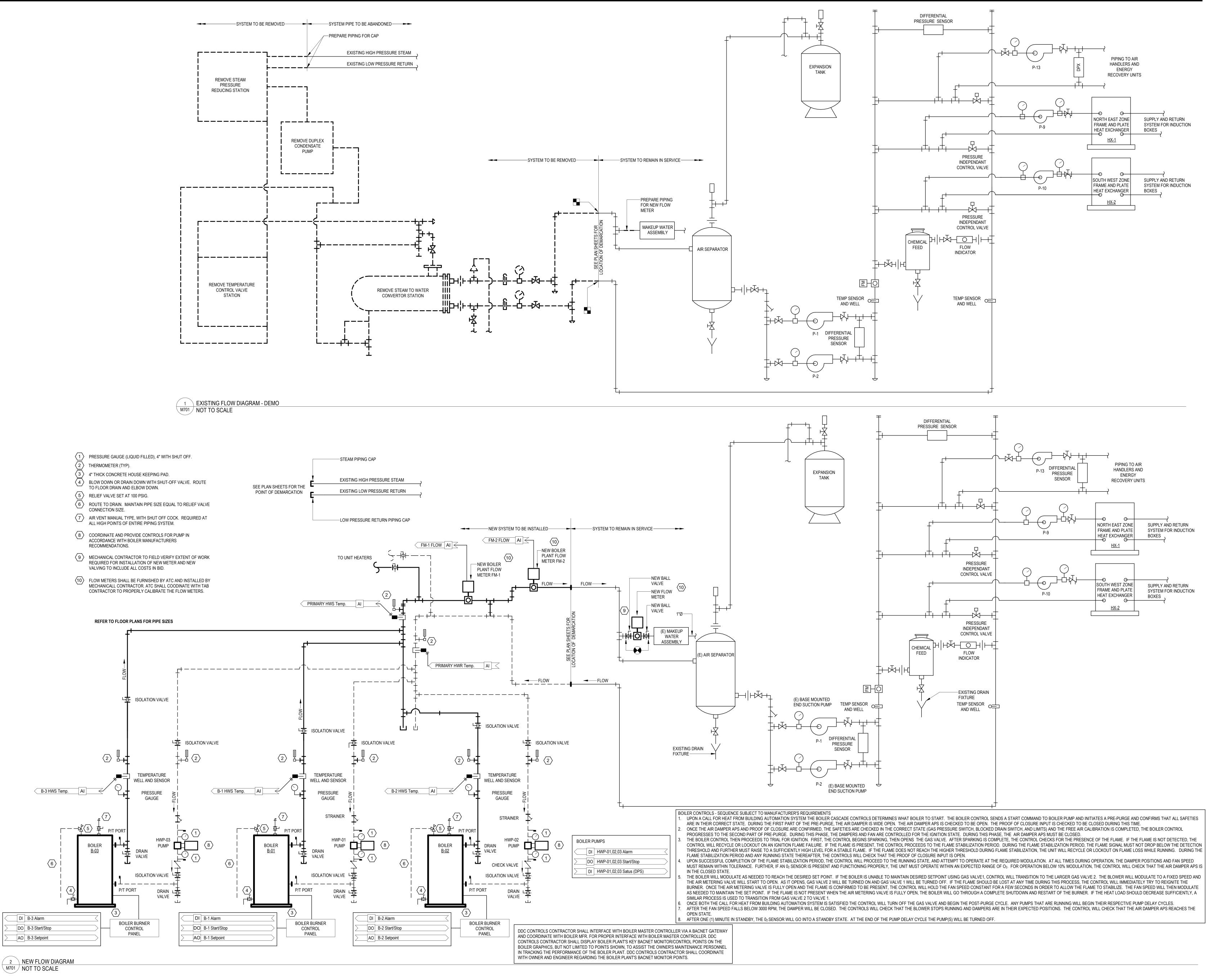
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PROJECT NAME:
Building #3 Hydronic Boiler System Upgrades

1900 Kanawha Boulevard East, Charleston, WV 25305

DRAWING TITLE: FIRST FLOOR **ENLARGED POWER PLANS** 

DRAWN BY: MM CHECKED BY:TZ3 PROJ. NO: GSD-221-C DRAWING NO:



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Building #3 Hydronic Boiler System Upgrades

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HYDRONIC FLOW DIAGRAM

FILE: XXX

DRAWN BY: MWE

CHECKED BY:TZ3

PROJ. NO: GSD-221-C

DRAWING NO:

M701

							Е	LECT	RICAL	EQU	JIPMENT :	SCHE	DULE					
	LOCATION					EQUIPMENT INFORMATION							CIRCUIT INFORM	DISC	INTERLOCK			
ID	NAME	NO	NO NO. F		REAL POWER	FLA	MCA	МОСР	VOLT	PH	PANEL	NO.	APPARENT LOAD	LOAD CLASSIFICATION	WIRE & CONDUIT	TYPE	ID	REMARKS
Boiler																		
B-01	BOILER ROOM	1			4143 W	11.5 A	14.5 A	25.0 A	208 V	3	LP4E101	13,15,17	4143 VA	MN	4#12,#12G,3/4"C	NFS		
B-02	BOILER ROOM	1			4143 W	11.5 A	14.5 A	25.0 A	208 V	3	LP4E101	19,21,23	4143 VA	MN	4#12,#12G,3/4"C	NFS		
B-03	BOILER ROOM	1			4143 W	11.5 A	14.5 A	25.0 A	208 V	3	LP4E101	14,16,18	4143 VA	MN	4#12,#12G,3/4"C	NFS		
Hot Water l	Jnit Heater	'		•														
UH-01	LOADING	LP101	1	0.02 hp	115 W	1.0 A	1.3 A	15.0 A	115 V	1	L1PP	85	115 VA	MTR	EXISTING	(E)		
UH-02	LOADING	LP101	1	0.02 hp	115 W	1.0 A	1.3 A	15.0 A	115 V	1	L1PP	85	115 VA	MTR	EXISTING	(E)		
UH-03	LOADING PAVILION & ST	LP-01	1	0.02 hp	115 W	1.0 A	1.3 A	15.0 A	115 V	1	LBPP	37	115 VA	MTR	EXISTING	(E)		
UH-04	LOADING PAVILION & ST	LP-01	1	0.02 hp	115 W	1.0 A	1.3 A	15.0 A	115 V	1	LBPP	37	115 VA	MTR	EXISTING	(E)		
UH-05	BOILER ROOM	1	1	0.03 hp	115 W	1.0 A	1.3 A	15.0 A	115 V	1	LP4E101	20	115 VA	MTR	2#12,#12G,3/4"C	NFS		
Inline Fan		'				II.												
SF-01	BOILER ROOM	1	1	0.75 hp	1261 W	3.5 A	4.4 A	15.0 A	208 V	3	LP4E101	8,10,12	1261 VA	MTR	4#12,#12G,3/4"C	NFS	CD-01, CD-02	2
Pump																		
HWP-01	BOILER ROOM	1	1	3.00 hp	2738 W	7.6 A	9.5 A	17.1 A	208 V	3	LP4E101	1,3,5	2738 VA	MTR	4#12,#12G,3/4"C	СВ		1
HWP-02	BOILER ROOM	1	1	3.00 hp	2738 W	7.6 A	9.5 A	17.1 A	208 V	3	LP4E101	2,4,6	2738 VA	MTR	4#12,#12G,3/4"C	СВ		1
HWP-03	BOILER ROOM	1	1	3.00 hp	2738 W	7.6 A	9.5 A	17.1 A	208 V	3	LP4E101	7,9,11	2738 VA	MTR	4#12,#12G,3/4"C	CB		1
START FVNR FVR 2-SPD VFD RVS	ER TYPES:  FULL VOLTAGE NON- FULL VOLTAGE REVE TWO SPEED  VARIABLE FREQUEN REDUCED VOLTAGE	RSING	SING F	S FUS IFS NON ICP MOT	N DISCONNECT SWITCH INTERPOLATION CIRCUIT FOR CIRCUIT FOR CUIT FOR CUIT BREAKER	CH PROTECTOR	HOA RP	RED (R GREEN ON-OFI	CES: DFF-AUTO UN) PILOT I (POWER) F SELECTO START PUS	LIGHT PILOT LIGI PR SWITCH	EC MC HT GC I TC	MECHANI GENERAL	CAL CONTRACTO CAL CONTRACTO CONTRACTOR TURE CONTRO	TOR				

INPUT AND OUTPUT CONDUCTORS TO AND FROM VFD'S SHALL BE INSTALLED IN SEPARATE RACEWAYS, INDEPENDENT FROM ANY OTHER CONDUCTORS, AND SHALL NOT PASS THRU ANY COMMON WIREWAY OR RACEWAY.
 MECHANICAL CONTRACTOR SHALL PROVIDE 24V WIRING TO MOTORIZED DAMPERS.

	DISC	CONNECT SC	HEDULE		
TYPE MARK	AMP RATING	VOLTAGE	POLES	FUSE	ENCLOSURE
DS-1	100A	480V	3	NF	1
DS-2	200A	208V	4	150A	1
B-01	30A	120V	2	NF	1
B-02	30A	120V	2	NF	1
B-03	30A	120V	2	NF	1

	LOCATION	I			DDIMADY	OF OOND A DV		MOUNTING	
IDENTIFICATION	NAME	NUMBER	KVA	PHASE	PRIMARY VOLTAGE	SECONDARY VOLTAGE	IMPEDANCE	MOUNTING STYLE	NOTES
T1	GENERATOR	LP103	45	3	480 V	208Y/120	3.44%	PAD MOUNTED	
T2	BOILER ROOM	1	15	3	208 V	480V		WALL MOUNTED	BOILER MANUFACTURER FURNISHED
Т3	BOILER ROOM	1	15	3	208 V	480V		WALL MOUNTED	BOILER MANUFACTURER FURNISHED
Т3	BOILER ROOM	1	15	3	208 V	480V		WALL MOUNTED	BOILER MANUFACTURER FURNISHED

LOCATION: MOUNTING: SUR MAIN DEVICE: 150.0 BUS AMPS: 200.0	0 A MAIN		I		C. RA					4 W. YMME	ΓRICA	<b>L</b>		
LOAD DESCRIPTION	BKR	Р	СКТ		SE A		SE B		SE C	СКТ	Р	BKR	LOAD	DESCRI
			1	0.9	0.9					2				
HWP-01	20 A	3	3			0.9	0.9			4	3	20 A	HWP-02	
			5					0.9	0.9	6				
			7	0.9	0.4					8				
HWP-03	20 A	3	9			0.9	0.4			10	3	20 A	SF-01	
			11					0.9	0.4	12				
			13	1.4	1.4					14				
BOILER B-01	20 A	3	15			1.4	1.4			16	3	20 A	BOILER E	3-03
			17					1.4	1.4	18			1	
		_	19	1.4	0.1					20	1	15 A	UH-05	
BOILER B-02	20 A	3	21			1.4	0.2			22	1	20 A	OUTDOO	
00.0505071.01.50	00.4		23		0.0			1.4	0.2	24	1	20 A	LIGHTS BOILER ROO	
GP RECEPTACLES	20 A	1	25	0.9	0.2	0.0	0.0			26	1	20 A	WP RECEPTACLE	
SPARE	20 A	1	27			0.0	0.0	0.0	0.0	28	1	20 A	SPARE	
SPARE	20 A	1	29	0.0	0.0			0.0	0.0	30	1	20 A	SPARE	
SPARE	20 A	1	31	0.0	0.0	0.0	0.0			32	1	20 A	SPARE	
SPARE SPARE	20 A 20 A	1	33 35			0.0	0.0	0.0	0.0	34 36	1	20 A 20 A	SPARE SPARE	
SPACE	20 A		37	0.0	0.0			0.0	0.0	38	-		SPACE	
SPACE		_	39	0.0	0.0	0.0	0.0			40			SPACE	
SPACE			41			0.0	0.0	0.0	0.0	40			SPACE	
OI AUL	т-		LOAD:	ΩL	(VA	7 L	VA		:VA	44			SFACE	
		-	AMPS:		) A		.0 A		2 A					
LOAD CLASSIFICATION		NNEC			EMAN			OZ TIMAT				PΔN	ANEL TOTALS	
Other		376 V			00.009			376 V				1 74		
RCPT		080 V			00.00			080 V				ONNECT	TED LOAD:	23280 /
LITES		309 V											DEMAND:	
					25.009			86 VA						
MTR		214 \			08.339			399 V					CURRENT:	
MN	12	2429 \	VA	10	00.009	%	12	429 V	/A	ES	ST. DE	EMAND (	CURRENT:	66.7 A

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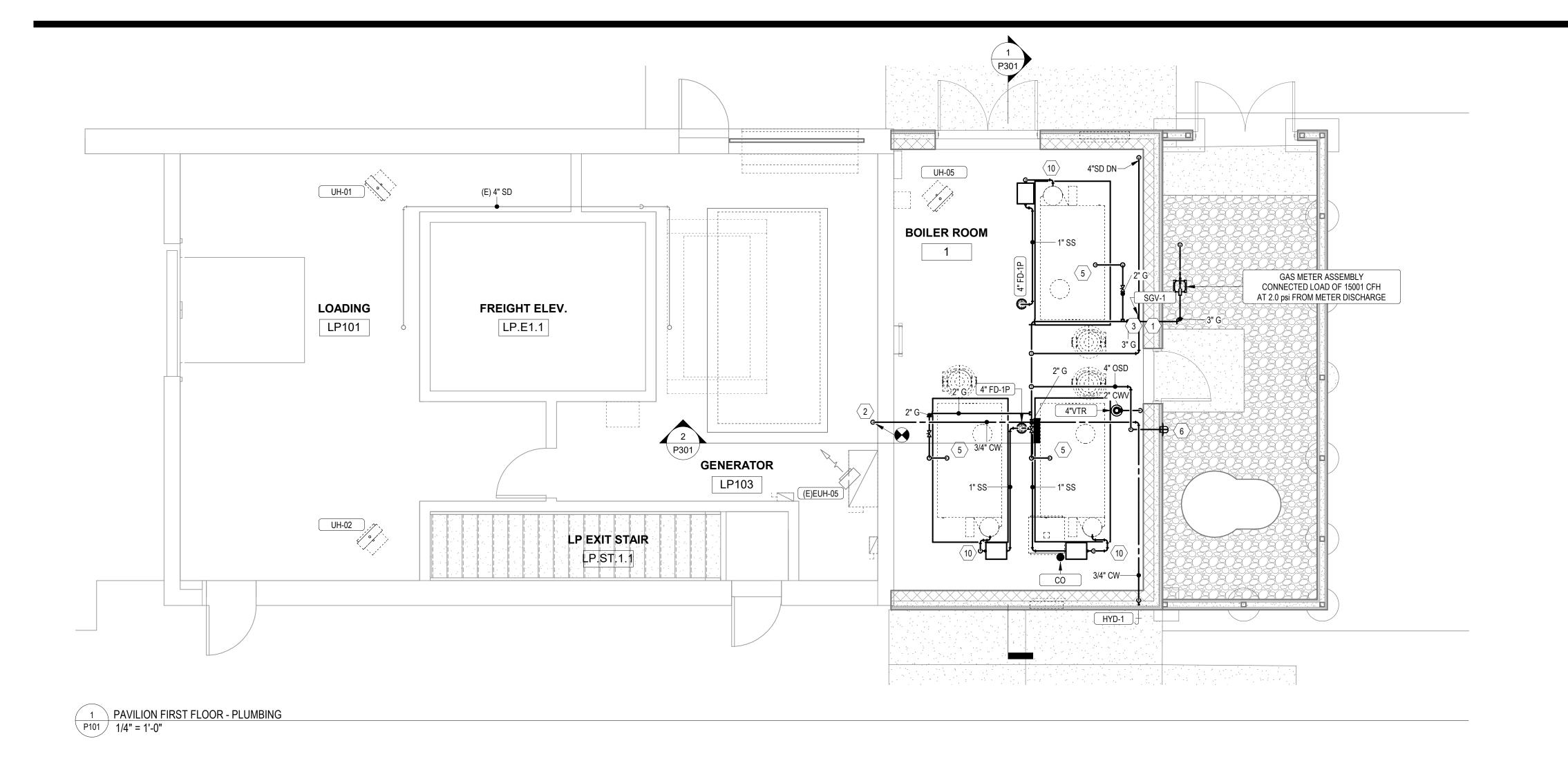
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DRAWING TITLE:
ELECTRICAL SCHEDULES

FILE: XXX
DRAWN BY: MM E601



4" CWV-

CO -

— 4" CWV

4" FD-1P

**BOILER ROOM** 

**GENERATOR** 

LP103

(E) 3/4" CW

FREIGHT ELEV.

LP.E1.1

LP EXIT STAIR

LP.\$T.1:1

LOADING LP101

←—(E) 3/4" CW

PAVILION FIRST FLOOR - UNDERFLOOR PLUMBING
1/4" = 1'-0"

### **GENERAL NOTES**

- FIELD VERIFY ALL NEW WATER, WASTE, AND VENT PIPING CONNECTIONS AND PROVIDE NEW CONNECTIONS AS REQUIRED FOR PROPERLY OPERATING SYSTEMS.
- PITCH UNDERFLOOR SANITARY WASTE AND STORM PIPING 3" AND GREATER AT 1/8" PER FOOT, UNLESS NOTED OTHERWISE. PITCH ALL OTHER WASTE PIPING AT 1/4" PER FOOT UNLESS OTHERWISE NOTED.
- FIELD VERIFY LOCATION AND INVERTS OF SITE UTILITIES PRIOR TO INSTALLATION. 4 ROUTE DOMESTIC WATER, FIRE PROTECTION, SANITARY SEWER, AND STORM SEWER
- SERVICES TO SITE UTILITIES 5'-0" FROM BUILDING UNLESS NOTED OTHERWISE. REFER TO CIVIL WASTE AND VENT PIPING BELOW FLOOR AND THROUGH FLOOR SHALL BE 2" MINIMUM.
- 6 PROVIDE CLEANOUT IN ACCESSIBLE LOCATION AT THE BASE OF ALL PLUMBING RISERS. ALL PLUMBING VENTS THROUGH ROOF SHALL BE EXTENDED TO A MINIMUM OF 6" ABOVE PARAPET HEIGHT AND MAINTAIN 25'-0" MINIMUM FROM ALL OUTSIDE AIR INTAKES. ALL VENTS SHALL BE A MINIMUM OF 18" ABOVE ROOF. NO PVC PIPING ABOVE ROOF. USE COPPER OR CAST

IRON.

## **KEYNOTES**

- 1 PROVIDE MANUAL GAS SHUT-OFF VALVE WHERE GAS LINE ENTERS THE BUILDING. 2 EXTEND DOMESTIC COLD WATER FROM EXISTING WATER SUPPLY PIPING. INSTALL ELECTRIC ACTUATED NATURAL GAS SHUT OFF VALVE IN GAS MAIN TO SHUT OFF NATURAL GAS SUPPLY TO BUILDING WHEN EMERGENCY PUSH STOP OCCURS. SEE DETAIL 2/M702 FOR CONTROLS DIAGRAM.
- 4 CONNECT NEW UNDERGROUND 4" STORM TO EXISTING SITE STORM PIPING. 5 CONNECT 2-1/2" GAS PIPING TO BOILER GAS INLET. INSTALL FIELD SUPPLIED NATURAL GAS REGULATOR, SHUT OFF VALVE, AND DRIP LEG BEFORE EACH EQUIPMENT CONNECTION. PROVIDE TARGET GAS SUPPLY PRESSURE OF 7" W.C.
- WHEN BOILER IS OPERATING. OVERFLOW STORM DRAIN PIPING TO EXTERIOR WALL MOUNTED SCUPPER. SEE ARCHITECTURAL DRAWINGS FOR SCUPPER LOCATION AND SPECIFICATIONS.
- INSTALL NEW UNDERGROUND 4" SANITARY PIPING UNDER ADDITION. 8 INSTALL NEW 4" SANITARY PIPING TO EXISTING SANITARY.

9 INSTALL UNDERGROUND DOMESTIC WATER SUPPLY PIPING UNDER BOILER ROOM

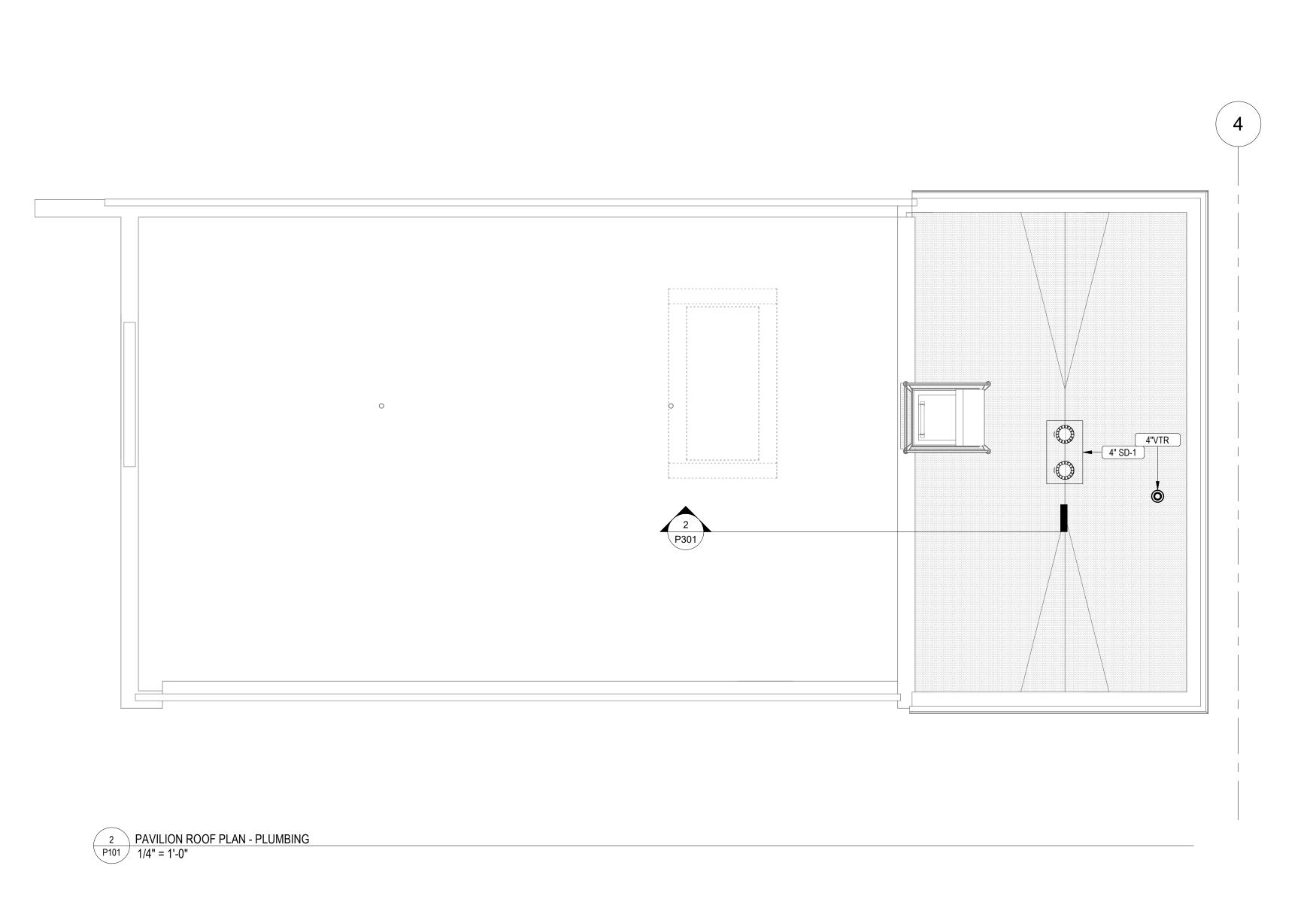
ADDITION TO FLOOR DRAIN TRAP PRIMER CONNECTIONS. 10 INSTALL 1" CONDENSATE PIPING FROM BOILER AND CONNECT TO FACTORY PROVIDED CONDENSATE TRAP AND SEPARATE CONDENSATE NEUTRALIZATION TANK. INSTALL CONDENSATE PIPING FROM NEUTRALIZATION TANK TO FLOOR DRAIN. INSTALL 3/8" SILICONE HOSE VENT LINE FROM BOILER TO CONDENSATE

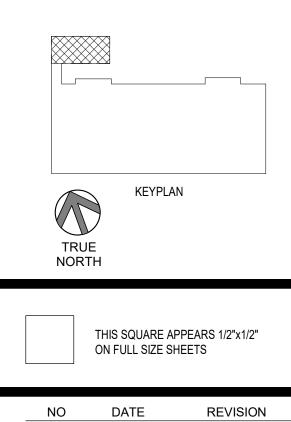
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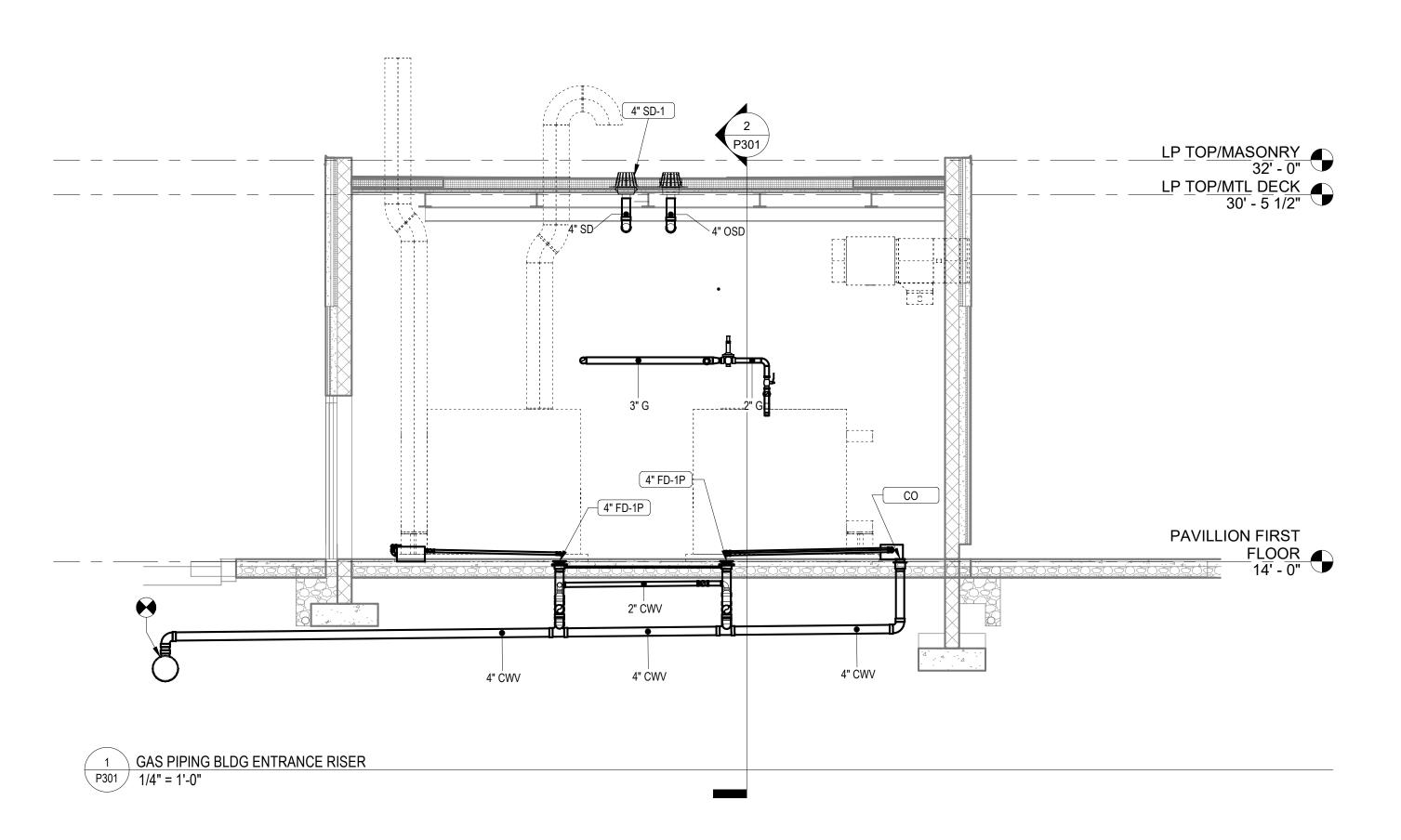
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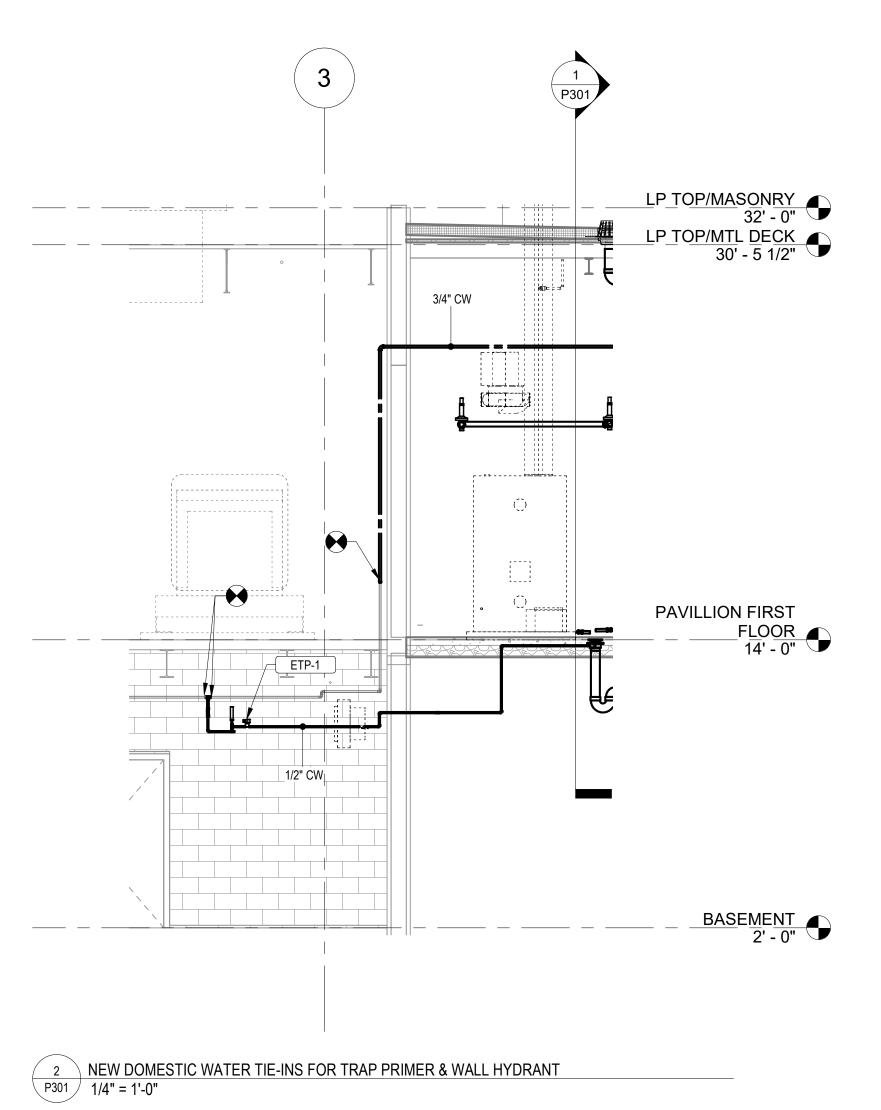
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**PAVILION PLUMBING PLANS** 

P101

DRAWN BY: PSO CHECKED BY:TZ3 PROJ. NO: GSD-221-C DRAWING NO:





GENERAL NOTES - NEW CONSTRUCTION

- 1 THESE DRAWINGS ARE BASED UPON HISTORICAL DRAWINGS OF THE EXISTING BUILDING AND FIELD VERIFICATION OF PORTIONS OF THE WORK. ADDITIONAL FIELD INVESTIGATION BY CONTRACTOR IS REQUIRED PRIOR TO SUBMISSION OF BIDS TO VERIFY THE INFORMATION SHOWN IS ACCURATE. CONTRACTOR SHALL PROVIDE UPDATES TO REFLECT ANY CHANGES IN THE RECORD DRAWINGS TO BE SUBMITTED AT THE CLOSE OF THE PROJECT.
- NOT ALL DETAILS ARE SHOWN IN ONE LOCATION. REFER TO ISOMETRICS, FLOW DIAGRAMS, DETAILS, ENLARGED PLANS, AND FLOOR PLANS FOR ADDITIONAL INFORMATION.
- NO CONCENTRIC REDUCERS WILL BE USED IN HORIZONTAL PIPING. ALL ECCENTRIC REDUCERS SHALL BE INSTALLED FLAT SIDE DOWN.
   FOR 2" AND SMALLER PIPING PROVIDE UNIONS AT VALVES, STRAINERS, FINAL EQUIPMENT
- FOR 2" AND SMALLER PIPING PROVIDE UNIONS AT VALVES, STRAINERS, FINAL EQUIPMENT CONNECTIONS AND ELSEWHERE INDICATED.
   FOR 2 1/2" AND LARGER PIPING PROVIDE FLANGED VALVES, STRAINERS, FINAL EQUIPMENT
- CONNECTIONS AND ELSEWHERE INDICATED.

  6 CONTRACTOR SHALL FURNISH AND INSTALL INSULATION ON ALL NEW PIPING, FITTINGS, VALVES AND EQUIPMENT UNLESS OTHERWISE RECOMMENDED BY THE EQUIPMENT MANUFACTURER. CONTRACTOR SHALL INCLUDE ADDITIONAL INSULATION IN THE BASE BID PROPOSAL, BEYOND WHAT IS INDICATED AND NOTED IN THE BID DOCUMENTS, AS FOLLOWS:

  •PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) ON EXISTING PIPE AND FITTINGS AT POINTS
- OF NEW PIPE CONNECTIONS;

  •WHERE NEW VALVES AND FITTINGS ARE SHOWN INSTALLED IN EXISTING PIPING SYSTEMS, PROVIDE A MINIMUM OF FIVE (5) LINEAL FEET (LF) OF INSULATION ON EITHER SIDE OF THE COMPONENTS FOR THE EXISTING PIPE AND FITTINGS;

  •ALLOW FOR AN ADDITIONAL 100 LF OF INSULATION FOR EXISTING PIPE AND FITTING IN SIZES UP

TO 8" NPS TO BE APPLIED WHERE MISSING/DAMAGED INSULATION IS ENCOUNTERED AND AS

DIRECTED BY THE OWNER/ENGINEER.
•REFER TO SPECIFICATIONS SECTION FOR DETAILS ON THE INSULATION REQUIREMENTS.
ALL COSTS FOR COMPLETE FURNISHING AND INSTALLING THE ADDITIONAL INSULATION

DESCRIBED HERE SHALL BE INCLUDED IN THE CONTRACTOR'S BASE BID PROPOSAL.

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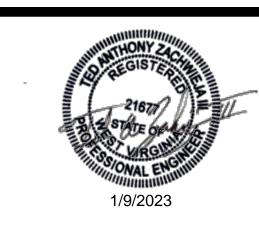
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DRAWING TITLE:
MECHANICAL PLUMBING
SECTIONS

FILE: XXX

DRAWN BY: PSO

CHECKED BY:TZ3

PROJ. NO: GSD-221-C

DRAWING NO: