SECTION 220000 - PLUMBING GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION

A. All work under this Section shall comply with the requirements of General Conditions, Supplemental Conditions, Special Conditions and Division 1 - General Requirements, and shall include all Sections of Division 22 and shall apply to all Work specified, indicated in the Drawings, and as required to furnish a complete installation of mechanical systems for the Project. Review all Sections of the Specifications for related work and coordinate the work of this Section with all other Sections.

B. Furnish all labor, services, materials, tools, equipment, appliances, facilities, transportation and incidental work and appurtenances required to furnish a complete and properly operating system.

C. The Contractor shall refer to the architectural interior details, floor plans, elevations, and the structural and other Contract Drawings and shall coordinate the work with that of the other trades to avoid interference. The plans are diagrammatic and show the general arrangement of the conduit, panels, transformers and equipment. All dimensions and existing conditions shall be the responsibility the Contractor. Before proceeding with work check and verify all dimensions.

D. The Contractor shall assume all responsibility for fitting of materials and equipment to other parts of equipment and structure. Make adjustments that may be necessary or as requested, in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades. Where existing pipes, conduits and/or ducts prevent installation of new work as indicated, relocate, or arrange for relocation with the applicable trades, existing pipes, conduits and/or ducts.

E. Where the project involves interface with existing building and site systems, the Consultant has used reasonable care to identify existing utilities and services. The Contractor is responsible to thoroughly familiarize themselves with existing conditions and be aware that in some cases information is not available i.e. concealed conditions, which exist in the existing building affected by this work.

F. Documents do not represent to show or list every item to be provided. When an item not shown or listed, is necessary for proper operation of the system and/or equipment, the Contractor shall provide the item which will allow the system to function properly at no increase in Contract Sum.

G. Work shall include, but shall not be limited to, the following:

1. Tie-ins to the existing plumbing system.
2. Relocation of existing systems which interfere with new construction.
3. Removal of existing piping, fixtures, equipment and appurtenances, to be abandoned.
4. Coordinate maintenance of existing services during construction with Owner.
5. Special coordination of chases and shafts.
6. Hoisting and rigging required to complete work of this section.
7. Sleeves, inserts and hangers.
8. Equipment bases and supports.

9. Vibration isolators, and seismic restraints.
10. Motors.
11. Domestic Cold Water System
12. Domestic Hot Water and Recirculation System
13. Sanitary Waste and Vent System
14. Storm Sewer System
15. Grey Water System
16. Black Water Treatment
17. Rainwater Capture System
18. Condensate Drain System
19. Kitchen Waste and Vent System
20. Laboratory Waste and Vent System
21. Prime painting.
22. Equipment and major component identification.
23. Instruction manual and start up instructions.
24. Testing and balancing.
25. Commissioning.
26. Cleaning.

H. Related work specified elsewhere: The following work, unless otherwise noted is not included in this section shall be performed in other sections:

1. Fire Suppression Equipment. Division 21
2. Mechanical Equipment. See Division 23.
3. Integrated Automation. See Division 25
4. Excavation and backfill.
5. Concrete work, including concrete housekeeping pads and other pads and blocks for vibrating and rotating equipment, duct bank envelopes and cast in place manholes and handholes, except as part of an inertia base. See Division 3
6. Cutting and patching of masonry, concrete, tile and other parts of structure, with the exception of drilling for hangers and providing holes and openings in metal deck.
7. Flashing of wall and roof penetrations.
8. Installation of access panels in floors, walls, furred spaces or above ceilings
9. Partitions and Painting (except as specifically indicated) See Division.
10. Structural supports necessary to distribute loading from equipment to roof or floor, except as specified herein.
11. Foundation drainage systems and site drainage structures.
12. Paving

1.2 QUALITY ASSURANCE

A. General:

1. All equipment and accessories shall be the product of a manufacturer regularly engaged in its manufacturer.
2. All equipment and accessories shall be new and free from defects.
3. Supply all equipment and accessories in compliance with the applicable standards listed in this Section and with all applicable National, State and Local Codes.
4. All items of a given type shall be the product of the same manufacturer.
5. Install work by craftsmen skilled in trade involved and by apprentices as indicated in the general conditions. Rough work will be rejected.
6. The subcontractor must, within the last five years, prior to the bid opening, have successfully completed in a timely fashion at least three projects similar in scope and type to the required work.

B. Requirement of regulatory agencies:

1. In accordance with requirements of Division 1 and as specified herein.
2. Nothing in the Drawings or Specifications shall be construed to permit Work not conforming to applicable laws, ordinances, rules or regulations.
3. When Drawings or Specifications exceed requirements of applicable laws, ordinances, rules or regulations, Drawings and Specifications take precedence.
4. It is not the intent of Drawings and Specifications to repeat requirements of codes except where necessary for completeness or clarity.
5. If any of the requirements of the above are in conflict with one another, or with the requirements of these specifications, the most stringent requirements shall govern.

C. Green Building Performance Requirements

1. The Contractor shall implement practices and procedures to meet the Project's GREEN BUILDING requirements. The Contractor shall ensure that the requirements related to these goals, as defined in Section 018113: "Sustainable Design Requirements", and as specified in this Section, are implemented to the fullest extent. Substitutions or other changes to the work shall not be proposed by the Contractor or their sub-contractors if such changes compromise the stated GREEN BUILDING Performance Criteria.

1.3 APPLICABLE PUBLICATIONS

A. Materials and equipment shall be manufactured, installed and tested as specified in latest editions of applicable publications, standards, rulings and determinations of:

1. Local and state building, plumbing, mechanical, electrical, fire and health department codes.
2. American Society of Plumbing Engineers (ASPE)
3. American Water Works Association (AWWA)
4. American Society of Mechanical Engineers (ASME)
5. American Welding Society (AWS)
6. American National Standards Institute (ANSI).
7. American Society of Testing and Materials (ASTM).
8. Underwriter's Laboratories (UL).
9. National Fire Protection Association (NFPA).
10. Occupational Safety and Health Act (OSHA)

B. All materials and equipment shall be listed by Underwriters" Laboratories (UL), and approved by ANSI, and ASTM for intended service.

C. Most recent editions of applicable specifications and publications of the following organizations form part of these Contract Documents.

1. American National Standards Institute (ANSI)
2. American Water Works Association (AWWA)
3. American Society of Mechanical Engineers (ASME)
4. American Welding Society (AWS)
5. American Society of Testing and Materials (ASTM)
6. American Society of Plumbing Engineers (ASPE)
7. Underwriter's Laboratories (UL).
8. National Fire Protection Association (NFPA).
9. Occupational Safety and Health Act (OSHA)

1.4 DEFINITIONS

A. "Provide" means "furnish and install", complete, the specified material, equipment or other item and perform all required labor to make a finished and properly operational installation.

B. "Furnish" means to purchase and deliver to project site complete with all appurtenance and support. "Install" means to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project

C. "Consultant" means "Prime Design Consultant". An individual or organization engaged by the owner or the architect to render professional engineering consulting services complementing or supplementing the architect's services concerning the content of the Mechanical, Electrical, Plumbing & Fire Protection sections of specifications.

D. "Owner" means the individual or entity with whom Contractor has entered into the Agreement for whom the Work is to be performed

E. "Construction Manager Advisor" or "CMA" means the Construction Manager that provides services to advise the Owner and Architect on design and materials decisions during the design and document development process. The CMA coordinates the entire design process using his skills and knowledge of construction to clarify cost and time considerations of design decisions, to advise on feasibility of single, multiple-contract or fast-track delivery systems, recommend the construction process, and to handle the bidding and award, as well as to manage the construction of the Project.

F. "Construction Manager Constructor" or "CMC" means the Construction Manager that in addition to acting as an advisor to the Owner during a design period, assumes responsibility for the construction of the Project. The CMC become contractually bound to provide the labor and material for the Project. The CMC may also serve as administrator of multiple prime contract construction; however, some states prohibit that practice.

G. General Contractor/ Prime Contractor means the contractor who contracts with a property owner and, in turn, employs a subcontractor or subcontractors to perform some of all of the work.

H. "Contractor" or "Subcontractor" means the trade contractor responsible for the work in this Division of the specification.

I. "Owner's Representative" means the Consultant, Engineer, or other Specialty Consultant retained by the Owner.

J. "RFI" means "Contractor's Request for Information".

K. "Above Grade": Not buried in the ground and not embedded in concrete slab on ground.

L. "Accessible": Ability to perform recommended maintenance without removal of services or equipment and requiring no special platforms.

M. "Actuating" or "Control" Devices: Automatic sensing and switching devices such as thermostats, pressure, float, electro-pneumatic switches and electrodes controlling operation of equipment.

N. "Below Grade": Buried in the ground or embedded in concrete slab on ground.

O. "Concealed": Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces, or in enclosures. In general, any item not visible or directly accessible.

P. "Connect": Complete hook-up of item with required service.

Q. "Exposed": Not installed underground or "concealed."

R. "Indicated," "Shown" or " "Noted": As indicated, shown or noted on Drawings or Specifications.

S. "Install": To erect, mount and connect complete with related accessories.

T. "Piping": Pipe, tube, fittings, flanges, valves, controls, strainers, hangers, supports, unions, traps, drains, insulation, and related items.

U. "Reviewed," "Satisfactory" or "Directed": As reviewed, satisfactory, or directed by or to Architect/Engineer/Owner.

V. "Rough-In": Provide all indicated services in the necessary arrangement suitable for making final connections to fixture or equipment.

W. "Shall": An exhortation or command to complete the specified task.

X. "Similar" or "Equal": Of base bid manufacture, equal in materials, weight, size, design, and efficiency of specified products.

Y. "Supply": To purchase, procure, acquire and deliver complete with related accessories.

Z. "Typical" or "Typ": Exhibiting the qualities, traits, or characteristics that identify a kind, class, number, group or category. Of or relating to a representative specimen. Application shall apply to all other similarly identified on plan or detail.

AA. "Will": A desire to complete the specified task. Allows some flexibility in application as opposed to "Shall."

BB. "Wiring": Raceway, fittings, wire, boxes and related items.

CC. "Work": Labor, materials, equipment, apparatus, controls, accessories, and other items required for proper and complete installation.

DD. Reference by abbreviation may be made in the specifications and the Contract Drawings for Mechanical and Electrical Work in accordance with the following list:

1. HVAC Heating, Ventilating and Air Conditioning
2. GC General Contractor
3. USS United States Standards
4. ASTM American Society of Testing Materials
5. ASA American Standards Association
6. ADA: Americans with Disabilities Act.
7. ANSI: American National Standards Institute.
8. HP: Horsepower.
9. ICEA: Insulated Cable Engineers Association

10. IEEE: Institute of Electrical and Electronic Engineers.
11. NEMA: National Electrical Manufacturers' Association.
12. NETA: National Electrical Testing Association, Inc.
13. NFPA: National Fire Protection Association.
14. OSHA: Occupational Safety and Health Act.
15. ABS: Acrylonitrile-butadiene-styrene plastic.
16. CPVC: Chlorinated polyvinyl chloride plastic.
17. PE: Polyethylene plastic.
18. PVC: Polyvinyl chloride plastic.
19. EPDM: Ethylene-propylene-diene terpolymer rubber.
20. NBR: Acrylonitrile-butadiene rubber.
21. UBC: Uniform Building Code.
22. UL: Underwriters' Laboratories,

1.5 SCOPE

A. Perform work and provide material and equipment as shown on the drawings and/or as specified and/or as indicated in this section of the specifications. Completely coordinate all work of this section with work of other trades and provide a complete and fully functional installation

B. Drawings and Specifications form complimentary requirements; provide work specified and not shown, and work shown and not specified as though explicitly require by both. Although work is not specifically shown or specified, provide supplementary or miscellaneous items, appurtenances, devices and materials obviously necessary for sound, secure and complete installation.

C. Give notices, file plans, obtain permits and licenses, pay fees and back-charges, and obtain necessary approvals from authorities that have jurisdiction as required to perform work in accordance with all legal requirements and with Specifications, Drawings, Addenda and Change Orders, all of which are part of Contract Documents.

D. Contractor shall be responsible with obtaining all the final inspection as required by Local Code and ordinances.

1.6 CONTRACT DOCUMENTS

A. Listing of Documents does not limit responsibility of determining full extent of work required by these Contract Documents. Refer to the Consultant's, Plumbing, Electrical, HVAC and Fire Protection, Structural, Site Utility and all other drawings and other sections that types of and work of other trades with which work of this section must be coordinated

B. Except where modified by a specific notation to the contrary; it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.

C. Items referred to in singular number in Contract Documents shall be provided in quantities necessary to complete work.

D. Drawings are diagrammatic. They are not intended to be absolutely precise; they are not intended to specify coordinated routings and component. The purpose of the document is to indicate systems concept, the main components of the systems, and the approximate geometric relationships. Based on the systems concept, the main components and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational

E. Information and components shown on riser diagrams, but not shown on plans, and vice versa, shall apply and be provided as if expressly required on both

F. Data that may be furnished electronically by the Consultant is diagrammatic. Such electronically furnished information is subject to the same limitation of precision as heretofore described. If furnished, such data is for convenience and generalized reference, and shall not be substitute for Consultant's sealed or stamped construction documents.

1.7 ELECTRONIC MEDIA FILES

A. Construction drawings for this project have been prepared utilizing AutoCAD 2013.

B. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.

C. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Release" form provided by Buro Happold.

D. The electronic contract documents can be used to assist in the preparation of shop drawings and as-built drawings however the electronic media files obtained from Buro Happold are for reference only. The information may not be used in whole or in part for any other project.

E. The drawings prepared for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.

F. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

G. The information is provided to expedite the project and assist the Contractor with no guarantee by Buro Happold as to the accuracy or correctness of the information provided. Buro Happold accepts no responsibility or liability for the Contractor's use of these documents.

1.8 REVIEW OF CONTRACT DOCUMENTS AND SITE

A. With the submission of his bid, Contractor shall give written notice to the Owner of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of Authorities having jurisdiction, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his proposal for a complete project.

B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

C. The location and elevation of the underground utilities, such as sewers, electrical power, water piping, steam and steam condensate return piping, conduit, etc., is as exact as can be determined from available information and its accuracy cannot be guaranteed. Exact location and elevation of these services shall be verified prior to excavation or installation of any portion of the work indicated. Exercise special care when excavating at or near the general location of underground utilities to avoid damage to the utility services. The Contractors is responsible to insure worker safety.

D. The contractor shall also acknowledge having been to the site and examined conditions under which work must be performed including preparatory work done under other Sections or other Contracts or by the Owner. Report conditions to the Consultant. Do not proceed until defects have been corrected and conditions are satisfactory. Commencement of work shall be construed as complete acceptance of existing conditions and preparatory work.

E. Owner assumes no responsibility for any understanding or representation made during or prior to the negotiation and execution of this Contract unless such understanding or representations are expressly stated in the Contract, and the Contract expressly provides that the responsibility, therefore, is assumed by the Owner.

1.9 DISCREPANCIES IN DOCUMENTS

A. Where Drawings or Specifications conflict or are unclear, advise the Consultant in writing before award of Contract. Otherwise, Consultant's interpretation of the Contract documents shall be final, and no additional compensation shall be permitted due to discrepancies or ambiguousness thus resolved.

B. Where Drawings or Specifications do not coincide with manufacturer's recommendations, or with applicable codes and standards, alert the Consultant in writing before installation. Otherwise, make changes in installed work as the Consultant requires within Contract Price.

C. If the required material, installation, or work can be interpreted differently from drawing to drawing, or between drawings and specification, this contractor shall provide material, installation, or work which is of higher standard.

D. It is the requirement of these documents to have contractor provide systems and components that are fully complete and fully operational and fully suitable for intended use. There may be situations in the documents where insufficient information exists to precisely describe a certain component or subsystem, or the routing of the component or its coordination with other building elements. In cases such as this, where the contractor has failed to notify the Consultant of the situation in accordance with paragraph (A) above, the contractor shall provide specific component or subsystem with all parts necessary for the intended use, fully complete and operational, and installed in workmanlike manner either concealed or exposed per the design intent.

E. In cases covered by paragraph (D) above, where the contractor believes he needs the engineering guidance, he shall submit a sketch identifying his proposed solution and the Consultant shall review, note if necessary, and approve the sketch.

1.10 MODIFICATION IN LAYOUT

A. Plumbing, Electrical, HVAC, and Fire Protection Drawings are diagrammatic. They indicate general arrangements of mechanical and electrical systems and other work. They do not show all offsets required for coordination nor do they show exact routings and locations needed to coordinate with structure and other trades to meet the Consultant's requirements

B. In order to obtain the Architect's desired aesthetics in spaces used by building occupants; prior to installation of visible materials, finishes and equipment (including access panels, review Consultant's Drawings for desired locations and where not definitely indicated, request information from the Architect/Consultant.

C. Check Contract Drawings, as well as Shop Drawings, of all subcontractors to verify and coordinate spaces in which work of this section will be installed

D. Maintain maximum headroom at all locations. All conduit, piping, duct and associated components to be as tight to underside of structure as possible.

E. Make reasonable modifications in layout and components to prevent conflict with work of other trades and to coordinate according to Paragraphs A, B, C, and D above. Systems shall be run in an organized and rectilinear fashion.

F. Where conflicts or potential conflict exists and engineering guidance is desired, submit sketch of proposed resolution to the Consultant for review and approval

1.11 RFIs

A. If the RFI is a request to resolve a conflict or a un-clarity, or a request for additional detail, Contractor's RFI shall include a sketch or equivalent description of Contractor's proposed solution, in accordance with paragraph 1.9(E) above

1.12 PROJECT COMMUNICATION

A. The specification references communication and submittal of information and documents by the Contractor to the Engineers of Record and CM or vice versa. In all cases such communication shall be submitted to the CM who will review it before forwarding to the relevant party for review and response.

B. If the information provided is not in conformance with the specification the CM shall return it to the relevant Contractor for re-submission. The time taken for this process shall be factored into all work schedules and submissions.

1.13 MEASUREMENTS

A. Contractor shall base all his measurements, both horizontal and vertical from established benchmark. All work shall agree with these established lines and levels. He shall verify all measurements at site; and check the correctness of same as related to the work.

1.14 MATERIALS AND WORKMANSHIP

A. Materials shall be new, meet detailed requirements of the Contract Documents and be identifiable as being specified or substitute products.

B. Materials which do not conform to the requirements of the Contract Documents, are not equal to approved samples or are unsatisfactory or unsuited to the purpose for which they are intended, will be rejected.

C. All work shall be performed in the best and most workmanlike manner by tradesmen skilled in their respective trades and properly licensed.

D. All equipment shall be installed in accordance with the recommendation of the manufacturer.

E. Defective work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or other cause shall be removed within ten (10) days after written notice is given by the Owner's Representative and the work shall be re-executed by the Contractor. The fact that the Owner's Representative may have previously overlooked such defective work shall not constitute total or partial acceptance of it.

F. In no case shall a Bidder base his bid on a class of material or workmanship less than that required by the contract documents nor the governing codes and ordinances.

1.15 CHECKING AND TESTING EQUIPMENT BY CONTRACTORS AND MANUFACTURER'S REPRESENTATIVE

A. All equipment shall be installed in strict accordance with manufacturer's instructions. During construction request supervisory assistance from equipment manufacturer's representatives so the equipment will be correctly installed. After installation, request the Owner's Representative to inspect and see the equipment is in proper working order.

B. Manufacturer's representative shall review the overall system design relative to the proper application of his equipment in the particular system. He shall note conduit, wiring, control, location, and other relevant relationships, and furnish appurtenances necessary for satisfactory operation.

C. Before final payment is issued the following shall be complete:

D. The Contractor's representative shall submit to the CM a signed statement certifying:

1. The equipment is properly installed and ready for operation

2. The owner's maintenance representatives have been thoroughly trained
3. Maintenance and operation manuals issued and accepted by the Owner's Representative.

1.16 TEMPORARY FACILITIES

A. Temporary water and waste per Division 1 requirements.

B. All temporary facilities shall be removed at completion of project.

1.17 SUBMITTALS

A. This paragraph supplements Division 1.

B. Definitions:

1. Shop Drawings are information prepared by the Contractor to illustrate portions of the work in more detail than shown in Contract Documents.
2. Coordination Drawings are detailed, large scale layout Shop Drawings showing Electrical, HVAC, Plumbing and Fire protection work superimposed in order to identify conflicts and ensure inter-coordination of Electrical, Mechanical, Plumbing, Fire Protection, Structural and other work.

C. Submittal Cover Sheet

1. Shop drawing submittal for each product shall include the copy of following cover sheet completely filled out. Incomplete or incorrect cover sheet submittal shall constitute reason for rejection.
2. Shop drawings shall be submitted according to specification section with a separate cover sheet completed for each product, rather than one cover sheet for multiple products, whether or not supplied by one manufacturer or vendor.
3. In order to maintain the shop drawing review schedule described hereafter, it is important that all submittals include a completed submittal cover sheet for each type of equipment submitted. This requirement will be enforced by the engineer.

SHOP DRAWING COVER SHEET			
PROJECT		CONTRACTOR	
DIVISION NO:		SECTION NO:	
DESCRIPTION:			
CONTRACT DRAWING REFERENCE NO:			
EQUIPMENT TAG:			
SUBMISSION (CIRCLE ONE): I II III IV			
DATE:			
INFORMATION AND CHECKLIST		REPLY	COMMENTS
4.	Contractor's Log # ID		
5.	Name, address, and phone number of supplier		
6.	Are all specified or scheduled items included and exactly match scheduled/specified items.	Yes No	
7.	Is this item a substitution?	Yes No	
8.	Are deviations clearly identified?	Yes No	
9.	Does this equipment fit space	Yes No	

	shown on construction documents, coordination drawings, and actual field conditions?		
10.	Has support, erection, weights, and installation been coordinated with all trades?	Yes No	
11.	Does the proposed installation void warranties and/or violate UL or code requirements?	Yes No	
12.	Does this material/equipment add expense to any other trade or project costs?	Yes No	
13.	Does equipment require interface with other trades? Lists divisions and specifics requiring coordination?	Yes No	
14.	Is control interface coordinated?	Yes No	
15.	List electrical characteristics (V/Ph/A)	Yes No	

D. Submittals procedure and format

1. Identify each item by manufacturer, brand, trade name, number, size, rating, or whatever other data is necessary to properly identify and check materials and equipment.
2. Identify each submittal item by reference to Specification Section paragraph in which item is specified, or Drawing and Detail number, identify deviations, if any.
3. Organize submittals in same sequence as they appear in Specification Sections, articles or paragraphs.
4. Shop Drawings shall show physical arrangement, construction details and finishes:
5. Drawings shall be drawn to scale and dimensioned where applicable.
6. Catalog cuts and published material shall be included to supplement scale drawings.
7. Internal wiring diagrams of equipment shall show wiring as actually furnished for this project, with all optional items clearly identified as included or excluded. Clearly identify external wiring connections. Identify and obliterate superfluous material.
8. Submittal literature, drawings and wiring diagrams shall be specifically applicable to this Project and shall not contain extraneous material or optional choices. Clearly mark literature to indicate the proposed item. Submittals shall include, but not be limited to those items listed in individual Sections.
9. Include all physical and performance data, including materials, manufacturer's names, model numbers, weights, sizes, capacities, performance curves, finishes, colors, accessories, installation instructions, and all other data required to completely describe equipment and to indicate complete compliance with Specifications and Drawings.
10. Include with complete submittals above, complete, large scale, dimensioned Shop Drawings, certified by manufacturer, of all major equipment.
11. Time Schedules for Submission and Ordering: The Contractor shall prepare, review and coordinate his schedule of submissions carefully, determining the necessary lead time for preparing, submitting, checking, ordering and delivery of all materials and equipment for timely arrival. The Contractor shall be responsible for conformance with the overall construction schedule.
12. Submittals shall be reviewed for general compliance with Specifications only. The Contractor shall be responsible for deviations from the Drawings or Specifications and for errors or omissions of any sort in submittals.

13. The Contractor shall add and sign the following paragraph on all equipment and materials submitted for review:
14. "It is hereby certified that the equipment, material shown and marked in this submittal is that proposed to be incorporated into the project; is in compliance with the Contract Drawings and Specifications and can be installed in the allocated spaces."
15. Failure to add the above written statement for compliance shall result in return of submittals to be reviewed.
16. The Contractor shall verify dimensions of equipment and be satisfied per Applicable Code Requirements for fit prior to submitting Shop Drawings for approval.
17. Where current limiting devices are specified, submit technical data to substantiate adequate protection of equipment cascaded downstream. Submittals shall not be reviewed unless supporting calculations and data are submitted therewith.
18. For any material specified to meet Underwriters' Laboratories, Inc. (UL) or trade standards, furnish the manufacturer's or vendor's certification that the material furnished for the work does in fact equal or exceed such Specifications.
19. Submit on all materials and equipment even if they are as specified or shown on the Drawings.
20. Equipment Floor Plans: After approval of material is secured, prepare a floor plan of each electrical equipment closet enclosures and room drawn to, scale of 1/2 inch equals 1 foot, and submit for approval in the same manner as for Shop Drawings. The layout drawings shall be to exact scale, and indicate location of all electrical equipment.
21. Resubmittals shall include written response to each item in review of previous submittal.

E. Acceptable Manufacturers: The Consultant's mechanical/electrical design for each product is based on the single manufacturer listed in the schedule or shown on the drawings. In Part 2 of the specifications certain Alternate Manufacturers are listed as being acceptable. These are acceptable only if, as a minimum, they:

1. Meet all performance criteria listed in the schedules and outlined in the specifications.
2. Have identical operating characteristics to those called for in the specifications. For example, a two stroke diesel generator will not be acceptable if a four stroke is specified.
3. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either space or product. Clearances to walls, ceilings and other equipment will be least equal to those shown on the design drawings. The fact that a manufacturer's name appears as acceptable shall not be taken to mean that the Consultants have determined that the manufacturer's products will fit within the available space. This determination is solely the responsibility of the contractor.
4. Products must adhere to all Consultant's considerations including, but not limited to: being of same color as the product scheduled or specified, fitting within Consultant's enclosures and details, and for diffusers, lighting and plumbing fixtures - being the same size and physical appearance as scheduled or specified products.
5. The proposed substitution shall meet performance and quality of scheduled equipment, whether it requires additional accessories or not.
6. There is no increase in Contract Sum and this Contractor shall pay for any additional work required by other trades as a result of the substitution.
7. Submit all equipment sound power and pressure level for review and compliance.

F. Required Use of Acceptable Manufacturers on his Project: Substitution of products other than those of the Acceptable Manufacturers specified herein shall not be made. Only the specified items or the comparable product by one of the specified Alternate Manufacturers shall be submitted. Products by other manufacturers shall not be used on this project.

G. Deviations:

1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice or other cause. Submit letter with transmittal of shop drawings, which flags deviation to the attention of the Consultants.
2. Without letters flagging the deviation to the Consultants, it is possible that the Consultants may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Consultants, the contractor shall hold the Consultants and his consultants harmless for any adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Consultants has reviewed or approved shop drawings containing the deviation, and will be strictly enforced.
3. Approval of proposed deviations, if any, will be made at discretion of Consultants.
4. Any of the approved deviations shall be deemed acceptable to this Contractor with no change in contract sum, unless the Consultant also receives a written notice to the contrary.

H. Submittal Notations: Submittals will be returned from the Consultants marked as illustrated below:

1. REVIEWED: "Reviewed and found generally acceptable. Minor deviations may be noted. No further submittal required if notations are complied with."
2. REVIEWED, DEVIATIONS NOTED; REVISE AND RESUBMIT: "Submittal contains deviations which must be corrected and confirmed by a new submittal."
3. REJECTED: "Submittal is incorrect to such an extent that the material is unacceptable, or in incomplete to such an extent that a review cannot be made. Resubmit in accordance with requirements of the Contract Documents."

I. Responsibility:

1. Intent of Submittal review is to check for capacity, rating, and certain construction features. Contractor shall ensure that the work meets the requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this or other Sections. Work shall comply with submittals marked "REVIEWED" to the extent they agree with the Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor shop drawing errors or deviations from requirements of Contract Documents. The Consultant's noting of some errors while overlooking the others will not excuse the contractor from proceeding in error. Contract Documents are not limited, waived nor superseded in any way by review.
2. INFORM SUBCONTRACTORS, MANUFACTURERS, SUPPLIERS, ETC. OF SCOPE AND LIMITED NATURE OF REVIEW PROCESS AND ENFORCE COMPLIANCE WITH CONTRACT DOCUMENTS.

J. Schedule: Incorporate shop drawing review period into construction schedule so that Work is not delayed. Contractor shall assume full responsibility for delays caused by not incorporating the following review time requirements into his project schedule. Working days listed reference the time in Engineer's office. It does not include transmittal time or review time of Contractor or the Consultant. Allow at least 10 working days, exclusive of transmittal time, for review each time shop drawing is submitted or resubmitted with the exception that 20 working days, exclusive of transmittal time, are required for the following:

1. Coordination Drawings.
2. If more than five shop drawings of a single trade are received in one calendar week.

1.18 List of Proposed Equipment and Materials:

A. Within four weeks of Award of Contract and before ordering materials or equipment, submit complete list of materials and equipment and indicate manufacturer's name, addresses and telephone numbers. No consideration will be given to partial lists submitted out of sequence.

B. If the List of Materials and Equipment is not received within the prescribed time limit, provide the first-named manufacturer for all material and equipment on this project.

1.19 EQUIPMENT SUPPLIER'S INSPECTION Modify list of equipment as required.

A. The following equipment shall not be placed in operation until a competent installation and service representative of the manufacturer has inspected the installation and certified that the equipment is properly installed, adjusted and lubricated; that preliminary operating instructions have been given; and that the equipment is ready for operation:

B. Modify list to suit systems used

C. Pressure Boosting Pumps

D. Water Heater Equipment

E. Solar Water Heating System

F. Uninterrupted Power Supply

G. Fire Seal Systems

H. Seismic Restraints and Equipment Bracing

I. Contractor shall arrange for and obtain supplier's on-site inspection(s) at proper time(s) to assure each phase of equipment installation and/or connection is in accordance with the manufacturer's instructions.

J. Submit copies of start-up reports to the Engineer and include copies IN THE Project Close-Out and Owner's Operation and Maintenance Manuals.

K. Refer to each Section for specific equipment inspection requirements and procedure.

1.20 COORDINATION DRAWINGS:

A. A single set of coordination drawings shall be mutually prepared by all mechanical and electrical trades.

B. The initiation of these drawings begins with Sheet Metal Subcontractor.

C. The Sheet Metal Subcontractor shall prepare a complete set of electronic background drawings at scale not less than 3/8" equals 1'-0", showing structure and other information as needed for coordination. He shall show sheet metal layout thereon. These will be Coordination Drawings.

D. Each of the mechanical, electrical, plumbing and other specialty trade shall add its work to these background drawings with appropriate elevations and grid dimensions. Specialty trade information is require for fan rooms and mechanical rooms, horizontal exits from duct shafts, crossovers, and for spaces in and above ceilings where congestion of work may occur such as corridors, and even entire floors. Drawings shall indicate horizontal and vertical dimensions, to avoid interference with structural framing, ceilings, partitions, and other services.

E. Each specialty trade shall sign and date each coordination drawing. Return drawing to the Sheet Metal Subcontractor, who shall route them sequentially to all specialty trades.

F. Where conflicts occur with placement of materials of various trades, the Sheet Metal Subcontractor will be responsible to coordinate the available space to accommodate all trades. Any resulting adjustments shall be initialed and dated by specialty trade. The Sheet Metal Subcontractor shall then final date and sign each drawing. If he cannot resolve conflicts, the decision of the General Contractor/Construction Manager shall be final.

G. A Subcontractor who fails to promptly review and incorporate his work on the drawings shall assume full responsibility of any installation conflicts affecting his work and of any schedule ramifications.

H. Sheet Metal Subcontractor shall make prints of all coordination drawings. Fabrication shall not start until such transparencies of completed coordination drawings are received by the Consultant/Engineer and have been reviewed and approved.

I. The review of coordination drawings shall not diminish responsibility under this Contract for final coordination of installation and maintenance clearances of all systems and equipment with the other trades, structural and other work.

J. After review:

1. After review of coordination drawings, the method used to resolve interferences not previously identified shall be as in "MODIFICATIONS IN LAYOUT" above.
2. All changes to reviewed coordination drawings shall be in writing by the Consultants/Engineer prior to start of work in affected area.

K. Distribution of Coordination Drawings:

1. The Sheet Metal Subcontractor shall provide the following distribution of documents:

    a. One sepia (reproducible) of each Coordination Drawing to each specialty trade and affected Contractor for their use.
    b. One reproducible of each Coordination drawing to Owner.
    c. One sepia (reproducible) of each coordination drawing to the General Contractor/Construction Manager.
    d. The above documents can be submitted as electronic media upon agreement of all parties.

L. ALL FIREWALLS AND SMOKE PARTITIONS SHALL BE HIGHLIGHTED ON COORDINATION DRAWINGS FOR APPROPRIATE COORDINATION.

M. The main paths of egress and for equipment removal from main mechanical and electrical rooms must be clearly shown on coordination drawings.

N. Coordination Drawings shall include, but not limited to:

1. Plumbing systems, piping and equipment.
2. HVAC piping, systems and equipment.
3. Control systems.
4. Electrical distribution, systems and equipment.
5. Lighting systems and fixtures.
6. Sheet metal work, components and accessories, costs and boxes in terminals, etc.
7. Fire protection and sprinkler system, piping and heads.
8. Structural.
9. Electrical Equipment Room layouts.
10. Environmental Rooms and associated refrigeration/heating systems.
11. Partition/room layout.
12. Ceiling tile and grid.
13. Access panels.
14. Smoke and fire dampers.
15. Roof drain piping.
16. Major electrical conduit runs, panel-boards, feeder conduit and racks of branch conduit.
17. Above ceiling miscellaneous metal.
18. Heat tracing of piping.
19. Minimum access space requirements for all equipment for both installation and maintenance.

1.21 COORDINATION BUILDING INFORMATION MODEL (BIM)

A. General Requirements:

1. The General Contractor shall appoint a BIM Coordination Manager to prepare a BIM Execution Plan developed specifically for the project, and based on the Computer Integrated Construction (CIC) Research Program's BIM Planning procedures. The BIM Execution Plan will establish the protocols, expected levels of development, and authorized uses of Building Information Models on this Project and assigns specific responsibility for the development of each Model Element to a defined Level.

B. Services to be modelled:

1. All piping (above ½") and all equipment shall be modelled based on the proposed submitted products. The model may be used for production of shop drawings.

C. Clash Detection:

1. Perform three-dimensional component conflict analysis as part of coordination process with all other trades, including but not limited for Mechanical, Plumbing, Fire Protection and Fire Alarm. Resolve component conflicts prior to submittal of shop drawings. Indicate where conflict resolution requires modification of design requirements by Construction Manager.

D. 3D Assets:

1. The contractor shall hand over all digital data files related to the BIM execution plan at the end of the construction process, including all, but not limited to the shop drawings and as built conditions.

1.22 REGULATIONS, CODES, PERMITS, AND FEES

A. Conform to all rules, regulations, standards, ordinances and laws of local, state, and Federal governments and other authorities that have legal jurisdiction over the site.

B. Prior to commencement of work, notify State and applicable authorities as required and submit all of the applicable notifications for construction, operation and demolition. Secure required permits and inspections from any of the authorities having jurisdiction, for this work and pay for all fees required for permits, inspections and review, including special agency construction.

C. Include all utility and local building department charges for providing temporary and permanent electric services to buildings.

D. Provide Owner, Owner's Representative and Inspectors from any of the authorities / agencies having jurisdiction access to work at all times.

E. Contractor shall be responsible for all law violations caused by the work under this Division. Notify Construction Manager in writing when a discrepancy occurs between code requirements and work shown on drawings and resolve matter before proceeding with work.

F. When requirements cited in this specification conflict with each other or with Contract Documents, most stringent shall govern work. Consultants may relax this requirement when such relaxation does not violate ruling of authorities that have jurisdiction. Approval for such relaxation shall be obtained in writing.

G. Make corrections in the work as required by the Owner's Representative or Inspector to pass local regulations.

H. Contractor shall deliver to the Construction Manager any and all certificates of inspections, permits, and approvals. Contractor shall submit final inspection certificates signed by governing authorities to the Owner.

I. Make all necessary submissions to the Department of Environmental Protection, Bureau of Air Resources and Management, Department of Labor and Industry and other agencies having jurisdiction. Pay all required fees for review, registration and sign off.

1.23 OPERATING AND MAINTENANCE MANUALS

A. Obtain at time of purchase of equipment, three copies of operation and maintenance manuals for all items. Assemble literature in coordinated "D" ring notebooks. All information shall also be provided in electronic PDF format. Divide the manuals into three sections or books as follows:

B. System General Description and Information. Section shall include a general description of the systems used and contain names and addresses of manufacturers and local representatives who stock or furnish or repair parts for items or equipment. List of all major equipment as installed and include model number, capacities, nameplate data and manufacturer's location and purchase order information. Include in the manuals, parts catalogs for each item of equipment furnished with the components identified by number for replacement ordering. This section shall also include:

1. Letters from manufacturers certifying their supervision of equipment installation and startup procedures as required.
2. Factory certification test certificates.
3. Equipment test certificates.

C. Operation, Start-up and Shutdown Procedures. Section shall include directions for and sequence of operation for each item of the Plumbing, Mechanical and Electrical systems.

D. Provide a step-by-step write-up and video of the operation, start-up and shut down procedures for all major equipment.

E. Problems, Solutions and Troubleshooting. Section shall include detailed procedures to be followed in case of equipment or system malfunctions. Include manufacturer's printed troubleshooting procedures into the operating manual for reference.

F. Preventative Maintenance. Section shall include preventative maintenance requirements and schedule for each piece of equipment.

G. Furnish three copies of manuals to the Consultant for approval and distribution to Owner. Deliver manuals no less than 30 days prior to project close-out or 10 days prior to commissioning whichever is sooner.

1.24 RECORD DOCUMENTS (AS-BUILTS)

A. As work progresses and for duration of Contract, maintain current complete and separate sets of prints of Contract drawings at job site. Record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to original design. Include actual location of existing utilities if they differ from design documents.

B. Underground utility services, both inside and outside of buildings, shall be dimensioned from permanent structures or benchmark. Utility services outside of buildings shall also show depth of burial with reference to the finished ground floor elevation.

C. Drawings shall show record condition of details, sections, riser diagrams, control changes and correction to schedules. Schedules shall show actual manufacturer and make and model numbers of final equipment installation. All elements shall be dimensioned from grid lines or benchmarks and all elevations shall be noted. Construction notes (such as component numbers, conflict notes, etc.) shall be removed and the drawings shall clearly be noted in the title block as being as-built drawings.

D. At the completion of the project, prepare a complete set of record drawings, showing all systems actually installed, as well as electronic files on latest CAD version.

E. The design tracings will be made available for Contractor's copying, at his expense, into reproducible to serve as background drawings. The quantity of design tracings, which are made available shall in no way be interpreted as setting a limit to the number of drawings necessary to show required information. Contractor's professional draftsperson shall transfer changes to record files and then submit the electronic files and three sets of prints to the Consultant for comments as to compliance with this section.

F. The record set reproducible, as corrected and recorded by the Contractor, shall be submitted to the Owner's Representative for approval prior to authorization for final payment. Record drawings shall be certified as to their correctness by the signature of the Contractor, and shall be stamped or otherwise identified as record drawings. THE CONSULTANT WILL NOT CERTIFY THE ACCURACY OF THE RECORD DRAWINGS - THIS IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR.

G. Each trade shall submit a record set for approval by the building department in a form acceptable to the department, when required by the jurisdiction. Such drawing format size changes, and supplemental information required for the submittal are the requirement of the contractor.

1.25 COOPERATION BETWEEN TRADES

A. Cooperate with all other Divisions performing work on this project as necessary to achieve a complete neatly fitted installation for each condition. Consult the Drawings and Specifications to determine nature and extent of work specified in other Divisions that adjoins or attaches to the work of this Division. Confer with other Divisions at the site to coordinate this work with theirs in view of job conditions to the end that interferences may be eliminated and that maximum head room and clearance may be obtained. In the event that interferences develop, the Owner's Representative's decision will be final as to which Division shall relocate its work, and no additional compensation will be allowed for the moving of piping, ductwork, conduit, or equipment, to clear such interferences. Provide templates, information, and instructions to other divisions to properly locate holes and openings to be cut or provided

1.26 HOIST, RIGGING, TRANSPORTATION AND SCAFFOLDING

A. Provide all scaffolding, staging, cribbing, tackle hoist and rigging necessary for placing all materials and equipment in their proper places in the Project. All temporary work shall be removed from the premises when its use is no longer required.

1.27 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in its original package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction.

B. Identify materials and equipment delivered to Site to permit check against approved materials list, reviewed Shop Drawings.

C. Keep all materials clean, dry and free from damaging environments during construction.

D. Cap all openings in piping daily to protect against entry by foreign matter.

E. Protect premises and Work of other Divisions from damage arising out of installation of Work of this Division.

F. Perform Work in manner precluding unnecessary safety and hazard.

G. Protect from loss or damage. Replace lost or damaged materials and equipment with new at no increase in Contract Sum. Protect from damage, water, dust, etc., material, equipment and apparatus provided under this Division, both in storage and installed, until Notice of Completion has been filed. Provide temporary storage facilities for material and equipment. Material, equipment or apparatus damaged because of improper storage or protection will be rejected. Remove from Site and provide new, duplicate material, equipment or apparatus in replacement of that rejected.

H. All stock piled piping shall be placed on dunnage, and protected from weather and from entry of foreign material. All stored materials and equipment shall be carefully inspected prior to installation and replaced with new material or equipment if found to be damaged, corroded, etc.

1.28 GUARANTEE AND 24 HOUR SERVICE

A. Guarantee the Work of this section for one year following the date of Substantial Completion or successful system performance whichever requires later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the owner.

B. The guarantee shall repair or replace defective materials, equipment, workmanship and installation that develop within this period, promptly and to the Consultant's satisfaction and correct damage caused in making necessary repairs and replacements under guarantee within Contract Price.

C. In addition to guarantee requirements of Division 1 and of Paragraph A above, obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's name.

D. Replace material and equipment that require excessive service during guarantee period as defined and as directed by the Consultant.

E. Provide 24 hour service beginning on the date of substantial completion and lasting until the termination of guarantee period. Service shall be at no cost to Owner. Service can be provided by this Contractor or a separate service organization. Choice of service organization shall be subject to the Consultant and Owner approval. Submit name and phone number that will be answered on a 24 hour basis each day of the week, for the duration of the service.

F. Submit copies of equipment and material warranties to Consultants before final payment.

G. At end of guarantee period, transfer manufacturer's equipment and warranties still in force to Owner.

H. This paragraph shall not be interpreted to limit Owner's rights under applicable codes and laws under this Contract.

I. Part 2 Paragraphs of the Specification sections may specify warranty requirements that may exceed those of this Paragraph.

J. Use of systems provided under this Section for temporary services and facilities shall not constitute Final Acceptance of work nor beneficial use by Owner, and shall not institute guarantee period.

K. Provide manufacturer's engineering and technical staff at site to analyze and rectify problems that develop during guarantee period immediately. If problems cannot be rectified immediately to Owner's satisfaction, advise the Consultant in writing, describe efforts to rectify situation, and provide analysis of cause of problem. Consultants will suggest course of action.

PART 2 PRODUCTS

2.1 GENERAL

A. Equipment and materials shall be as described in the respective Sections of Division 21, 22, 23 and Division 26 and as shown.

2.2 MATERIALS

A. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Furnish optional or additional accessories as specified. And or/as required to provide a fully operational installation.

B. Equipment, material damaged during transportation, installation, and operation is considered as totally damaged. Replace with new. Payment for this equipment shall not be approved. Variance from this permitted only with written acceptance.

C. All items of materials in each category of equipment shall be of one manufacturer.

D. Material and Equipment-General Requirements:

1. All equipment and components shall be New.
2. Testing agency labeled or with other identification wherever standards have been established.
3. Owner's Representative reserves right to reject items not in accordance with Specification either before or after installation.
4. Comprised to render complete and operable systems; provide additional items needed to complete installation to realized design.
5. Compatible with space allocated. Modifications necessary to adjust items to space limitations at Contractor's expense.
6. Installed fully operating and without objectionable noise or vibration.

PART 3 EXECUTION

3.1 COMMISSIONING OF EQUIPMENT AND SYSTEMS

A. General

1. Completion of startup and commissioning shall be accomplished as a prerequisite for substantial completion and shall be completed for each phase of construction.

2. Operate and maintain systems and equipment until final acceptance by Owner.
3. All guarantees and warranties shall not begin until final acceptance of the systems and equipment by the Owner. Acceptance requires, at a minimum complete systems and commissioning.
4. The Owner maintains the right to have access to the entire project site to develop his own operational procedures.

B. Comprehensive Work Plan and Reporting

1. Provide detailed, methodical, scheduled, start up and commissioning procedures and execution of same and every system and piece of equipment provided.
2. Attend start up and commissioning meetings on a regular basis, as directed by the General Contractor or Construction Manager.
3. Develop and provide a written work plan with detailed procedures for this work and submit, using shop drawing submittal procedure, within 6 weeks of the contract award. The work plan shall include provisions for an integrated start up plan and schedule. The plan and schedule shall identify tasks, start and completion dates, critical path items, interface requirements with other trades and major equipment start up, as minimum requirements of the plan. The plan and schedule shall clearly identify work in each construction phase, as well.
4. The purpose of this work plan is to provide for smooth, quick, and efficient start up and commissioning of systems and equipment and for a smooth transition to turn the complete, correctly operating building over to the Owner, at each phase of construction.
5. The Owner and the Consultant will have input to and be part of approval process for startup and commissioning plan.
6. Develop and submit for approval a specific start up, check out and sign off form for every piece of major equipment.
7. Develop and submit for approval a specific start up, check out and sign off form for every piece of major system.
8. Systems shall be operated under actual or simulated full load conditions. Identify the operating conditions in the work plan.
9. Work plan shall incorporate the below specified "Demonstration of Successful Operation"
10. The Consultant/Owner may check the completed and commissioned installation either sequentially as different parts are completed, and/or when the entire installation is complete, at sole option of the Consultant/Owner.
11. Each contractor shall arrange that an officer of his contracting company shall certify that each and every system has been tested. At the conclusion of the tests, this contractor shall submit a letter and enclosed commissioning forms signed by the officer stating:

    a. That he/she is the officer of the company.
    b. That he/she certifies that the specified testing of the systems has been performed by the company (give the name and dates of system testing).
    c. The results of testing as compared to specified performance, listing the name, title, and company affiliation of all those witnessing and performing these tests.

C. Commissioning

1. Commission equipment and systems in accordance with the approved work plan, completing the startup, check out and sign off forms for each piece of equipment and each system.
2. Provide qualified personnel, equipment, apparatus and services for startup and testing of equipment and systems, to obtain the performance shown in schedules, as specified or on commissioning forms, and as required by codes, standards, regulations and authorities having jurisdiction including Municipal Inspectors, Owners and Consultants.

3. Start up and testing procedures as may be outlined in various mechanical and electrical sections of the specifications are the minimum effort required for the project. Contractor shall use any additional procedures he feels will be necessary to properly start up and test the systems and equipment actually installed on the job at no additional cost to the Owner.
4. Provide capacity and performance of equipment by field testing. Install thermowells and gauge connections and, at no additional cost to Owner, equipment and instruments required for testing.
5. Qualified representative of equipment manufacturer shall be present at test.
6. For each piece of equipment, copy nameplate data and include with the letter and start up, check out and sign off forms referred to above.
7. Do not cover or conceal work before testing and inspection and obtaining approval.
8. Leaks, damage and defects discovered or resulting from startup and testing shall be repaired or replaced by this contract to like-new condition with acceptable materials. Tests shall be continued until system operates without adjustments or repairs.

D. Demonstration of Successful Operation: After all components and every system has been completely commissioned, provide a two week, 24 hour per day fully functional automatic operation period of all systems simultaneously. This shall be successfully concluded before systems are accepted by the Owner.

3.2 SPECIAL RESPONSIBILITIES:

A. Cooperate and coordinate with work of other Sections in executing work of this Section.

1. Perform work such that progress of entire project including work of other Sections shall not be interfered with or delayed.
2. Provide information as requested on items furnished under this Section which shall be installed under other Sections.
3. Obtain detailed installation information from manufacturers of equipment provided under this section.
4. Obtain final roughing dimensions or other information needed for complete installation of items furnished under other Sections or by Owner.
5. Keep fully informed as to shape, size and position of openings required for material or equipment to be provided under this and other Sections. Give full information so that openings required by work of this Section may be coordinated with other work and other openings and may be provided for in advance. In case of failure to provide sufficient information on proper time, provide cutting and patching or have same done, at own expense and to full satisfaction of Consultants.
6. Provide information as requested as to sizes, number and locations of pads necessary for floor mounted equipment provided under this Section.
7. Notify Consultants of location and extent of existing piping, conduit, ductwork and equipment that interferes with new construction. In coordination with and with approval of Consultants, relocate piping, ductwork and equipment to permit new work to be provided as required by Contract Documents. Remove non-functioning and abandoned piping, ductwork and equipment as directed by Consultants. Dispose of or store items as requested by Consultants.

B. Installation Only Items

1. Where this contractor is required to install items which it does not purchase, it shall coordinate delivery and be responsible for their unloading from delivery vehicles and for their safe handling and field storage up to time of installation. This trade shall be responsible for:

a. Any necessary field assembly and internal connections, as well as mounting in place of the items, including the purchase and installation of all dunnage supporting members and fastenings necessary to adapt to Consultant's and structural conditions.
b. Their connection to building systems including the purchase and installation of all terminating fittings necessary to adapt and connect them to the building systems.

2. This contractor shall carefully examine such items upon delivery. Claims that any of these items have been received in such condition that their installation will require procedures beyond the reasonable scope of work of this contractor will be considered only if presented in writing within one week of their date of delivery. Unless such claims have been submitted this contractor shall be fully responsible for the complete reconditioning or replacement of the damaged items.

C. Maintenance of equipment and systems: Maintain equipment and systems until Final Acceptance. Ensure adequate protection of equipment and material during delivery, storage, installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

D. Use of premises: Use of premises shall be restricted as directed by the Consultant and as required below:

1. Remove and dispose of dirt and debris, and keep premises clean. During progress of work, remove equipment and unused material. Put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to satisfaction of the Consultant.
2. Store materials in a manner that will maintain an orderly clean appearance. If stored on-site in open or unprotected areas, all equipment and material shall be kept off the ground by means of pallets of racks and covered with tarpaulins.
3. Do not interfere with function of existing sewers and water and gas mains, electrical or mechanical systems and services. Extreme care shall be observed to prevent debris from entering pipe, ductwork and equipment. Confer with the Consultant as to the disruption of services or other utilities due to testing, connection of new work to existing. Interruption of services shall be performed at time of day or night deemed by Owner to provide minimal interference with normal operation. Obtain Owner's approval of the method proposed for minimizing service interruption.

E. Surveys and Measurements:

1. Base measurements, both horizontal and vertical, on reference points established by Contractor and be responsible for correct laying out of work.
2. In event of discrepancy between actual measurements and those indicated, notify the Consultant in writing and do not proceed with work until written instructions have been issued by the Consultant.

F. Fireproofing:

1. Clip, hangers, clamps, supports and other attachments to surfaces to be fireproofed shall be installed, insofar as possible prior to start of spray fiber work.
2. Conduit and other items which would interfere with proper application of fireproofing shall be installed after completion of spray fiber work.

3. Patching and repairing of fireproofing due to cutting or damaging to fireproofing during course of work specified under this section shall be shall be performed by installer of fireproofing and paid for by the trade responsible for damage and shall not constitute grounds for an extra to Owner.

G. Temporary Utilities:

1. Refer to Division 1 regarding requirements.
2. Furnish temporary equipment, and piping as needed during the construction phase. Remove temporary items after use.

3.3 MATERIAL AND WORKMANSHIP

A. Work shall be neat and rectilinear. Conduit shall run concealed except in mechanical rooms and areas where no hung ceiling exists. Install material and equipment to comply with manufacturers. Recommended Requirements. Rough Work will be rejected. Work shall be properly and effectively protected, and conduit openings shall be temporarily closed to prevent obstruction and damage before completion.

B. Except as specified otherwise, material and equipment shall be new. Provide supplies, appliances and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents.

C. Finish of materials, components and equipment shall be as approved by the Consultant and shall be resistant to corrosion and weather as necessary.

D. Owner will not be responsible for material and equipment before testing, commissioning, and acceptance.

3.4 CONTINUITY OF SERVICES

A. Do not interrupt existing services without Owner's approval.

B. Schedule interruptions in advance, according to Owner's instructions. Submit, in writing, with request for interruption, methods proposed to minimize length of interruption.

C. Interruptions shall be scheduled at such times of day and work so that they have minimal impact to Owner's operations.

D. Subcontractor shall coordinate any shutdowns of existing systems as follows:

1. Give proper notice to Owner when making shutdowns; a minimum of fourteen full days are required.
2. Minimize shutdowns of any system.
3. Provide temporary services where required and perform shutdown and tie-ins at a time convenient to Owner.
4. Subcontractor shall be responsible for completing and filing Owner's shutdown notice questionnaire.
5. Perform required survey and inspection work required by the notice for shutdown.

E. Include premium time work associated with interruption of services and/or shutdown as necessary to avoid disruption to Owner's operations.

3.5 ANCHORS AND INSERTS:

A. Inserts shall be iron or steel of type to receive machine bolt head or nut after installation. Insert shall permit adjustment of bolt in one horizontal direction and shall develop strength of bolt when installed in properly cured concrete.

B. Provide anchors as necessary for attachment of equipment support and hangers.

3.6 CORE DRILLING

A. Core drilling is to be avoided.

B. Set sleeves prior to installation of structure for passage of conduits, etc.

C. Where core drilling is unavoidable, or required by renovation projects, locate all required openings prior to coring and submit to the Consultant for review.

D. Coordinate openings with General Contractor/Construction Manager and all other trades.

E. Core drilling is to be provided by the Contractor for General Construction and not by the M/E subcontractors.

F. Do not disturb existing systems.

G. Thoroughly investigate existing conditions in vicinity of required opening prior to coring.

3.7 CUTTING AND PATCHING:

A. Complete cutting and patching in accordance with Division 1, Cutting and Patching Article, and as follows.

B. Provide all sleeves, core drilling, carpentry, cutting and patching required for proper installation of material and equipment specified in this Division.

C. Do not cut or drill structural members without written approval of Owner's Representative and structural engineer.

D. No cutting or patching should be done without first receiving the Consultant's and Structural Engineer's written approval.

E. Any damage caused by cutting and patching shall be restored to the original condition as required by the Consultant.

3.8 VIBRATION CONTROL:

A. Coordinate with Division 1.

B. Design criteria for all the Work of Division 22 shall be as specified in 220548.

3.9 WATERPROOF CONSTRUCTION:

A. Maintain waterproof integrity of penetrations of materials intended to be waterproof. Provide flashing at exterior wall and roof penetrations. Caulk watertight penetrations of foundation walls and floors. Provide membrane clamps at penetrations of waterproof membranes.

B. Provide galvanized sheet metal weather protection canopies, hoods or enclosures over all out-of-doors equipment, the operation or maintenance of which would be impaired by rainwater. This requirement applies to damper operators and bearing, damper motors, controls, and instruments. See other paragraphs in this Division for application of this requirement to panels, motors, and devices.

3.10 RESTORATION OF DAMAGE:

A. Repair or replace, as directed by the Consultant and/or Owner's Representative, materials and parts of premises which become damaged as result of installation of Work of this Division. Remove replaced parts from premises.

3.11 ROOF OPENINGS AND CURBS

A. Roof openings where required shall be coordinated with the other affected trades and all flashing and patching shall be as per details indicated on the Consultant's plans.

3.12 TOOLS AND EQUIPMENT

A. Furnish all tools and equipment necessary for the proper installation, protection and upkeep of the Work.

3.13 ADJUSTMENTS

A. Preliminary Operation:

1. Operate any portion of installation for Owner's convenience if so requested by Construction Manager. Such operation does not constitute acceptance of Work as complete. Cost of utilities, such as gas and electrical power, will be borne by Owner if Owner requests operation.

B. Start-up Service:

1. Prior to startup, ensure that systems are ready for their intended use.

C. Start and operate all systems. Provide services of factory trained technicians for startup of major equipment and systems.

D. Adjusting:

1. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.

2. Thereafter, as a result of system operation or as directed by Owner's Representative, make readjustments as necessary to refine performance and to effect complete system "tune-up".
3. After completion of testing and adjustment, operate the different systems and equipment under normal working conditions for 72 hours continuously and show specified performance.
4. If, in the opinion of the Consultant, performance of equipment or systems is not in accordance with specifications or submitted data, alter or replace equipment at no increase in Contract Sum. The Contractor, at his option, may order tests from an independent approved laboratory to prove compliance. All such tests shall be at no increase in Contract Sum. Repeat process as often as required. If the reason for unsatisfactory operation is design errors all additional cost for corrective measures will be reimbursed to the contractor.
5. At completion of Work, provide written certification that all systems are functioning properly without defects.

E. Noise:

1. Cooperate in reducing any objectionable noise or vibration caused by electrical systems to the extent of adjustments to specified and installed equipment and appurtenances.
2. Cooperate in adjustment of mechanical systems and terminal devices, as directed by Owner's Representative, to obtain specified acoustic properties.
3. Completely correct noise problems caused by failure to make installation in accordance with Contract Documents, including labor and materials required as a result of such failure, at no increase in Contract Sum. Includes refinish walls, floors etc.

3.14 INSTALLATION OF EQUIPMENT

A. Use printed descriptions, specifications and recommendations of manufacturers as a guide for installation of Work.

B. Assemble equipment required to be field assembled under the direct supervision of the manufacturers' agent. Prior to the final acceptance submit letters from the manufacturers that this has been done.

C. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to the satisfaction of the Consultant and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.

D. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof mounted equipment shall be installed and supported on structural steel provided under other Sections.

E. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall of ceiling mounting of equipment as required.

F. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.

G. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installations.

H. Structural steel and hardware shall conform to Standard specifications of ASTM; use of steel and hardware shall conform to requirements of Section V of Code of Practice of American Institute of Steel Construction.

I. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly, which will void warrantee. Report in writing to the Consultant, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.

3.15 PAINTING

A. Equipment installed shall have shop coat of non-lead paint. Hangers and supports shall have one coat of non-lead primer. Finish painting, including painting of various conduit or wire way systems, shall be done under other Sections.

B. Paint all outside exposed equipment and equipment supports with two coats of weather resistant enamel.

C. Properly prepare Work under this Division to be finish painted under Division 9.

D. Refer to standard paint colors for all Plumbing equipment inside the Building.

3.16 SELECTIVE DEMOLITION

A. Refer to all drawings for general description of areas requiring demolition.

B. Refer to General Contractor's/Construction Manager's Instructions for all existing equipment and materials that shall remain the property of the Owner.

C. Items of value which are not directed to be returned to the Owner shall become the property of the Contractor. Storage or sale of items on the project site is prohibited.

D. Protection: Ensure the safe passage of persons in and around building during demolition. Prevent injury to persons and damage to property. Provide adequate shoring and bracing to prevent collapse. Immediately repair damaged property to the condition before being damaged. Take effective measures to prevent windblown dust.

E. Utilities: Maintain all utilities except those requiring removal or relocation. Keep utilities in service and protect from damage. Do not interrupt utilities serving used areas without first obtaining permission from the utility company and the Owner. Provide temporary services as required.

3.17 JOBSITE SAFETY

A. Neither the professional activities of the Engineer, nor the presence of the Engineer or his or her employees and sub-consultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Engineer and the Engineer's consultants shall be indemnified and shall be made additional insured's under the Contractor's general liability insurance policy.

3.18 FINAL JOBSITE OBSERVATION

A. As the work nears completion, the Contractor is to review the requirements of the Contract Documents, inspect the work and inform all parties involved of the work to be corrected or completed before the project can be deemed substantially complete.

B. When the Project is substantially complete, In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation. Notify the Owner's Representative in writing of this fact, listing any items of Work remaining incomplete, the reason therefore, and the anticipated date that all remaining work will be completed. The Contractor shall inform the certification that the project is complete and ready for a final punch; the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

C. It is understood that if the Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Engineers additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

D. The Contractor shall carry out their own final inspection and satisfy the Work.

E. The Owner's Representative reserves the right to cancel and reschedule the inspection in the event considerable more work remains to be completed or corrected than indicated in the written request for inspection.

F. All items not completed or found not complying with drawings or specifications by the Owner's Representative will be identified in their inspection report.

G. Correct all items on inspection report. Make the correction and initial and date each item on the report after corrections have been completed.

H. Include the fee for all local inspections.

3.19 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to video tape all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.
3. Description of emergency system operation.

3.20 PROJECT CLOSE-OUT PROCEDURE

A. General

1. The requirements of this section are in addition to and supplement the requirements outlined in Division 1.
2. It shall be each contractor's responsibility to personally hand-deliver all of the required project close-out checklist items and to obtain Owner's authorized representative(s) signed receipt on all items requiring Owner sign-off.

B. Project Close-Out Checklist

1. Review requirements of each section of the specifications and submit for approval to Consultants the sign-off forms which shall become the project close-out checklist. These, at a minimum, shall include the following information shown in attached Project Closeout Checklist Example. The Consultants and/or Owner may incorporate additional specific items to the following checklist which shall become part of project requirements.
2. Close-Out Checklist Example:

PROJECT CLOSE-OUT			
PROJECT:			
DIVISION NO:			
CONTRACTOR:			
ITEM1	DATES		OWNER'S SIGN-OFF
	COMPLETED	RECEIVED BY OWNER	
Permits			
City and County Inspection			
Manufacturer's Warranties			
Factory Startup Reports Submitted			
Copy of Final Shop Drawings			
List and Possession of Spare Parts			
Pressure Tests			
Equipment Tests Required by Specs			
O&M Manuals			
Record Documents			

Coordination Drawings			
Sanitization Reports			
Commissioning Reports/Letters/Forms			
On Site Training Complete			
Protective Device Settings			
Valve Tags and Charts			
Final ATC Installation Drawings			
Insurance Underwriters Approvals			
Final Punch List (Initialed by contractor that items are complete)			
Building Certificate of Occupancy			
24 Hr. Phone No. for Service During Guarantee Period.			
1 Provide separate line item for each specified item (do not group items).			

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

In order to prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

3. 1. Penetrations fire sealed and labeled in accordance with specifications.
4. 2. All pumps operating and balanced.
5. 3. All plumbing fixtures installed and caulked.
6. 4. Pipe insulation complete, pipes labeled and valves tagged.
7. 5. Factory startup reports for water softener and hot water systems
8. 6. Factory startup reports for pressure boosting system
9. 7. Factory startup reports for grey water treatment system
10. 8. Factory startup reports for black water treatment system

Accepted by:

Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Engineer so that the final observation can be scheduled.

It is understood that if the Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 220000

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Plastic or rubber waterstop collar with center opening to match piping OD.

PART 3 EXECUTION

3.1 SLEEVE INSTALLATION

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 , seal the space outside of sleeves in slabs and walls without sleeve-seal 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-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

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 material and size and for sleeve ID or hole size. 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-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use to seal the space around outside of sleeve-seal fittings.

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: Sleeve-seal fittings.

2. Exterior Concrete Walls below Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

b. Piping NPS 6 and Larger: Cast-iron pipe sleeves with sleeve-seal system.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

a. Piping Smaller Than NPS 6: Steel pipe sleeves .

5. Interior Partitions:

a. Piping Smaller Than NPS 6: Steel pipe sleeves.

END OF SECTION 220517

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Steel Type: With finish and setscrew fastener.

B. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.2 FLOOR PLATES

A. Split Floor Plates: Cast brass with concealed hinge.

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 insulated 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.
b. Chrome-Plated Piping: One-piece with polished, chrome-plated finish.
c. Insulated Piping: One-piece steel with finish.
d. Insulated Piping: One-piece stainless steel with polished stainless-steel finish.
e. Insulated Piping: One-piece cast brass with finish.
f. Insulated Piping: One-piece stamped steel [or split-plate, stamped steel with concealed hinge] [or split-plate, stamped steel with exposed-rivet hinge] with polished, chrome-plated finish.
g. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with finish.
h. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
i. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with finish.
j. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel [or split-plate, stamped steel with concealed hinge] [or split-plate, stamped steel with exposed-rivet hinge] with polished, chrome-plated finish.
k. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with finish.
l. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stainless steel with polished stainless-steel finish.
m. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with finish.
n. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel [or split-plate, stamped steel with concealed hinge] [or split-plate, stamped steel with exposed-rivet hinge] with polished, chrome-plated finish.
o. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
p. Bare Piping in Unfinished Service Spaces: One-piece cast brass with finish.
q. Bare Piping in Unfinished Service Spaces: One-piece stamped steel [or split-plate, stamped steel with concealed hinge] [or split-plate, stamped steel with exposed-rivet hinge] with polished, chrome-plated finish.
r. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
s. Bare Piping in Equipment Rooms: One-piece cast brass with finish.
t. Bare Piping in Equipment Rooms: One-piece stamped steel [or split-plate, stamped steel with concealed hinge] [or split-plate, stamped steel with exposed-rivet hinge] with polished, chrome-plated finish.

2. Bare Piping in Equipment Rooms: Split-plate, stamped steel with concealed hinge with polished, chrome-plated 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.

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION 220518

SECTION 220519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Dial-type pressure gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Standard: ASME B40.200.

B. Case: Liquid-filled type(s); stainless steel with 5-inch nominal diameter.

C. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F.

D. Connector Type(s): Union joint, rigid, bottom, with unified-inch screw threads.

E. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

F. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

G. Window: Plain glass.

H. Ring: Stainless steel.

I. Element: Bimetal coil.

J. Pointer: Dark-colored metal.

K. Accuracy: Plus or minus 1 percent of scale range.

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install test plugs in piping tees.

K. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

L. Install pressure gages in the following locations:

1. Building water service entrance into building.

2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

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. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct -mounted, -case, vapor-actuated type.
3. case, compact -style, liquid-in-glass type.
4. Direct -mounted, light-activated type.
5. Test plug with self-sealing rubber inserts.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be[one of] the following:

1. Liquid-filled, bimetallic-actuated type.
2. [Direct] [Remote]-mounted, -case, vapor-actuated type.
3. case, [compact] [industrial]-style, liquid-in-glass type.
4. [Direct] [Remote]-mounted, light-activated type.
5. Test plug with self-sealing rubber inserts.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:

1. Liquid-filled, bimetallic-actuated type.
2. Direct -mounted, -case, vapor-actuated type.
3. case, compact -style, liquid-in-glass type.
4. Direct -mounted, light-activated type.

D. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F.

B. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be one of the following:

1. Liquid-filled, direct -mounted, metal case.
2. Test plug with self-sealing rubber inserts.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:

1. Liquid-filled, direct -mounted, metal case.
2. Test plug with self-sealing rubber inserts.

C. Pressure gages at suction and discharge of each domestic water pump shall be[one of] the following:

1. Liquid-filled, direct -mounted, metal case.
2. Test plug with self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 100 psi.

B. Scale Range for Domestic Water Piping: 0 to 160 psi.

END OF SECTION 220519

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Brass ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and soldered ends.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. WATTS.

2. Description:

a. Standard: MSS SP-110 or MSS SP-145.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

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 valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.END OF SECTION 220523.12

SECTION 220523.13 - BUTTERFLY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Iron, single-flange butterfly valves.
2. Chainwheels.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set butterfly valves closed or slightly open.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B16.5 for flanges on steel valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B31.9 for building service piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For valves NPS 8and larger.
2. Handlever: For valves NPS 6 and smaller.
3. Chainwheel: Device for attachment to gear, handlever, or stem; of size and with chain for mounting height, according to "Valve Installation" Article.

H. Valves in Insulated Piping: With 2-inch stem extensions.

2.2 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. Iron, Single-Flange Butterfly Valves with Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; Conbraco Industries, Inc.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. WATTS.

2. Description:

a. Standard: MSS SP-67, Type I.
b. CWP Rating, NPS 12and Smaller: 200 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.
f. Stem: One- or two-piece stainless steel.
g. Disc: Stainless steel.

2.3 CHAINWHEELS

A. Description: Valve actuation assembly with sprocket rim, chain guides, chain.

1. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

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 mating flange faces for damage. 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.

D. 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 chainwheels on operators for butterfly valves [NPS 4] <Insert size> and larger and more than [96 inches] <Insert dimension> above floor. Extend chains to [60 inches] <Insert dimension> above finished floor.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

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.

END OF SECTION 220523.13

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61[and NSF 372].

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. WATTS.

2. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

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. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Check Valves: In horizontal or vertical position, between flanges.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

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. Pump-Discharge Check Valves:

a. NPS 2 and Smaller: Bronze swing check valves with [bronze] [or] [nonmetallic] disc.
b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, [metal-seat] [or] [resilient-seat] check valves.
c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered or press-ends.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.

END OF SECTION 220523.14

SECTION 220523.15 - GATE VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Iron gate valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. NRS: Nonrising stem.

C. OS&Y: Outside screw and yoke.

D. RS: Rising stem.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSP 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. RS Valves in Insulated Piping: With 2-inch stem extensions.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 IRON GATE VALVES

A. Iron Gate Valves, NRS, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. Milwaukee Valve Company.
c. NIBCO INC.
d. Red White Valve Corp.
e. WATTS.

2. Description:

a. Standard: MSS SP-70, Type I.
b. CWP Rating: 200 psig.
c. Body Material: Gray iron with bolted bonnet.
d. Ends: Flanged.
e. Trim: Bronze.
f. Disc: Solid wedge.
g. Packing and Gasket: Asbestos free.

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 chainwheels on operators for gate valves [NPS 4] <Insert size> and larger and more than [96 inches] <Insert dimension> above floor. Extend chains to [60 inches] <Insert dimension> above finished floor.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

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. Use gate valves for shutoff service only.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. For Grooved-End Copper Tubing: Valve ends may be grooved.

END OF SECTION 220523.15

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. 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.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
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 stainless steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, 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.

2.4 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.5 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. 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.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. 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 and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

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] <Insert size> 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.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 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.

3.6 PAINTING

A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-painted areas on miscellaneous metal are specified in Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Use copper-plated pipe hangers and stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction occurs.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction occurs.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. 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.

L. 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 of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11 split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use [powder-actuated fasteners] [or] [mechanical-expansion anchors] instead of building attachments where required in concrete construction.

S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220533 - HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes plumbing piping heat tracing for freeze prevention, domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

1. Self-regulating, parallel resistance.

B. Related Requirements:

1. Section 230533 "Heat Tracing for HVAC Piping."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

B. Shop Drawings: For electric heating cable.
1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. Chromalox.
2. Raychem; a brand of Tyco Thermal Controls LLC.

C. Comply with IEEE 515.1.

D. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.

E. Electrical Insulating Jacket: Flame-retardant polyolefin.

F. Cable Cover: Stainless-steel braid and polyolefin outer jacket with ultraviolet inhibitor.

G. Maximum Operating Temperature (Power On): 150 deg F.

H. Maximum Exposure Temperature (Power Off): 185 deg F.

I. 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.

2.2 CONTROLS

A. Provide BACnet interface for BMS monitoring

B. Pipe-Mounted Thermostats for Freeze Protection:
1. Remote bulb unit with adjustable temperature range from 30 to 50 deg F.
2. Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.
3. Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.
4. Corrosion-resistant, waterproof control enclosure.

2.3 ACCESSORIES

A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

B. Warning Labels: Refer to Section 220553 "Identification for Plumbing Piping and Equipment."

C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.

B. Electric Heating-Cable Installation for Freeze Protection for Piping:
   1. Install electric heating cables after piping has been tested and before insulation is installed.
   2. Install electric heating cables according to IEEE 515.1.
   3. Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."
   4. Install warning tape on piping insulation where piping is equipped with electric heating cables.

C. Set field-adjustable switches and circuit-breaker trip ranges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:
   1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
   2. Test cables for electrical continuity and insulation integrity before energizing.

3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.

E. Cables will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.5 PROTECTION

A. Protect installed heating cables, including nonheating leads, from damage during construction.

B. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets.

7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 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: Red.

C. Background Color: White.

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-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets.

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. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.4 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.

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 and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in [Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]

B. Pipe Label Locations: 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] <Insert dimension> along each run. Reduce intervals to [25 feet] <Insert dimension> in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:

1. Domestic Water Piping

a. Background: Safety green.
b. Letter Colors: White.

2. Sanitary Waste Piping:

a. Background Color: Safety purple.
b. Letter Color: White.

3.5 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 lawn-watering 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. Cold Water: 2 inches, round.
b. Hot Water: 2 inches, round.

2. Valve-Tag Colors:

a. Cold Water: Safety green.
b. Hot Water: Safety green.

3. Letter Colors:

a. Cold Water: White.
b. Hot Water: White.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Domestic chilled-water piping for drinking fountains.
5. Sanitary waste piping exposed to freezing conditions.
6. Storm-water piping exposed to freezing conditions.
7. Roof drains and rainwater leaders.
8. Supplies and drains for handicap-accessible lavatories and sinks.

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 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.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing 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.

C. Coordinate installation and testing of heat tracing.

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.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall 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 shall be qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA, Inc.
b. Armacell LLC.
c. K-Flex USA.

G. Mineral-Fiber, Preformed Pipe: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Manson Insulation Inc.

2. Preformed Pipe Insulation: Type I, Grade A, without factory-applied jacket.
3. 850 deg F.
4. Factory fabricate shapes in accordance with ASTM C450 and ASTM C585.
5. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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 of 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. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. 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, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

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.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches 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.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, 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 [preformed fitting insulation] [or] [mitered fittings] made from same material and density as that of 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 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 [preformed 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 [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 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. 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 fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as 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 FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as 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 preformed sections of same material as that of 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 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: [Two] <Insert number> finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless steel jackets.

3.10 FIELD QUALITY CONTROL

A. Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to [three] <Insert number> locations of straight pipe, [three] <Insert number> locations of threaded fittings, [three] <Insert number> locations of welded fittings, [two] <Insert number> locations of threaded strainers, [two] <Insert number> locations of welded strainers, [three] <Insert number> locations of threaded valves, and [three] <Insert number> locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be one of the following:

   a. Flexible Elastomeric: 1/2 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be[one of] the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: [1 inch] <Insert dimension> thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be[one of] the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Domestic Chilled Water (Potable):

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

F. Sanitary Waste Piping Where Heat Tracing Is Installed:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

G. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Flexible Elastomeric: 3/4 inch thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
c. Polyolefin: 3/4 inch 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 Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copper tube and fittings.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipe and tube.
2. Fittings.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Owner's written permission.

1.6 WARRANTY

A. Polypropylene Piping (PP-R) Manufacturer's Warranty: Manufacturer agrees to repair or replace PP-R pipe and fittings that fail in materials or workmanship within 10 years from date of Substantial Completion.

1. Warranty is to cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or manufacturing.

2. Warranty is to be in effect only upon submission by the Contractor to the manufacturer of valid pressure/leak documentation indicating that the system was tested and passed the manufacturer's pressure/leak test.

PART 2 PRODUCTS

2.1 PIPING MATERIALS

A. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B88, Type K.

B. Annealed-Temper Copper Tube: ASTM B88, Type K.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

E. Copper Tube, Pressure-Seal-Joint Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. Mueller Industries, Inc.
c. NIBCO INC.
d. Viega LLC.

2. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end.
3. Minimum 200-psig working-pressure rating at 250 deg F.

PART 3 EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

C. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Annealed-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be[one of] the following:

1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and soldered joints.
2. Drawn-temper copper tube, ASTM B88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be[one of] the following:

1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

H. Aboveground, combined domestic water-service and fire-service-main piping, NPS 6 to NPS 12DN 150 to, shall be[one of] the following:

1. Stainless steel Schedule 10 pipe, grooved-joint fittings, and grooved joints.

3.2 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install underground copper tube in PE encasement according to ASTM A674 or AWWA C105/A21.5.

E. Install valves according to the following:

1. Section 220523.12 "Ball Valves for Plumbing Piping."

2. Section 220523.13 "Butterfly Valves for Plumbing Piping."
3. Section 220523.14 "Check Valves for Plumbing Piping."
4. Section 220523.15 "Gate Valves for Plumbing Piping."

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level [with 0.25 percent slope downward toward drain] [without pitch] and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. 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.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. 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.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install pressure gauges on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gauges in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

T. Install thermometers on[inlet and] outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. 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. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

K. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. [Square cut] [Roll] groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

L. 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.

M. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

N. Joints for PEX Tubing, ASTM: Join according to ASTM F1807 for metal insert and copper crimp ring fittings and ASTM F1960 for cold expansion fittings and reinforcing rings.

O. Joints for PEX Tubing, ASSE: Join according to ASSE 1061 for push-fit fittings.

P. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for copper, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install vinyl-coated hangers for 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.

E. Support horizontal piping within [12 inches] <Insert dimension> of each fitting.

F. Support vertical runs of copper to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 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. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 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. Hydrostatic testing and documentation of test results for polypropylene piping to be in accordance with the manufacturer's instructions and submitted to the manufacturer upon successful completion per warranty requirements.
f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
g. 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 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-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 procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

END OF SECTION 221116

SECTION 221117 - GRAY-WATER PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground gray-water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Pipes, tubes, fittings, and specialties for each type of piping.
2. Joining materials.
3. Encasement for piping.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Water Piping Minimum Working Pressure: 50 psig unless otherwise indicated.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gray-water water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.

D. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install piping concealed from view and protected from physical contact by building occupants 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, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. 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.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

Q. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each gray-water water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

R. Install shutoff valve immediately upstream of each dielectric fitting.

S. Install gray-water water piping level [with 0.25 percent slope downward toward drain] [without pitch] and plumb.

T. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

U. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

3.3 WATER PIPE JOINT CONNECTIONS

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. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. 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."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Push-on Joints for Copper Tubing: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

H. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

I. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

J. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for gray-water water service. Join flanges with gasket and bolts according to ASME B31.9.

K. Joint Construction for Solvent-Cemented Plastic Piping: 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. Apply primer.
2. PVC Piping: Join according to ASTM D 2855.

L. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in the following Sections:

1. Section 220523.12, "Ball Valves for Plumbing Piping."
2. Section 220523.13, "Butterfly Valves for Plumbing Piping."
3. Section 220523.14, "Check Valves for Plumbing Piping."
4. Section 220523.15, "Gate Valves for Plumbing Piping."

B. Shutoff Valves:

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, supports, and anchor devices in Section 220529 "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 Feetand Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install hangers for copper tubing with maximum horizontal spacing and minimum rod diameters to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install vinyl-coated hangers for [PVC] [and] [PP] 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.

E. Support horizontal piping within [12 inches] <Insert dimension> of each fitting and coupling.

F. Support vertical runs of copper tubing to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of [PVC] [and] [PP] piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

C. Label all non-potable water piping "NON-POTABLE, DO NOT DRINK."

3.7 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 "Water Piping Tests" Subparagraph 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. Water Piping Tests:

a. Fill gray-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 gray-water 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. Gray-water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.8 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. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.9 GRAY-WATER PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, gray-water piping, [NPS 3] <Insert pipe size> and smaller, shall be[one of] the following:

1. Hard soft copper tube, [ASTM B 88, Type K] [ASTM B 88, Type L]; [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal fittings; and pressure-sealed] joints.

E. Aboveground gray-water piping, [NPS 2] <Insert pipe size> and smaller, shall be[one of] the following:

1. Hard copper tube, [ASTM B 88, Type L] [ASTM B 88, Type M]; copper, solder-joint fittings; and [brazed] [soldered] joints.
2. Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; copper push-on-joint fittings; and push-on joints.

F. Aboveground gray-water piping, [NPS 2-1/2to NPS 4] <Insert pipe size range>, shall be[one of] the following:

1. Hard copper tube, [ASTM B 88, Type L] [ASTM B 88, Type M]; copper, solder-joint fittings; and [brazed] [soldered] joints.
2. Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; grooved-joint, copper-tube appurtenances; and grooved joints.

3.10 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 or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: [Calibrated] [Memory-stop] balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of gray-water water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221117

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 Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Backflow preventers.
2. Balancing valves.
3. Water-hammer arresters.
4. Trap-seal primer device.

1.3 DEFINITIONS

A. AMI: Advanced Metering Infrastructure.

B. AMR: Automatic Meter Reading.

C. FKM: A family of fluroelastomer materials defined by ASTM D1418.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Flow Controls; Conbraco Industries, Inc.
b. WATTS.
c. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.

4. Pressure Loss: 8 psig maximum, through middle third of flow range.
5. Body: Bronze stainless steel for NPS 2 and smaller; ductile or cast iron with interior lining that complies with AWWA C550 or that is FDA approved stainless steel for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Flow Controls; Conbraco Industries, Inc.
    b. WATTS.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Body: Bronze stainless steel for NPS 2 and smaller; for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight-through flow.
8. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

2.3 BALANCING VALVES

A. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Flow Controls; Conbraco Industries, Inc.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Red-White Valve Corp.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass or stainless steel.
8. Seats and Seals: Replaceable.

9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.4 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AMTROL, Inc.
    b. Jay R. Smith Mfg Co; a division of Morris Group International.
    c. MIFAB, Inc.
    d. Precision Plumbing Products.
    e. Sioux Chief Manufacturing Company, Inc.
    f. WATTS.
    g. Zurn Industries, LLC.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows Piston Diaphragm.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.5 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. MIFAB, Inc.
    c. Precision Plumbing Products.
    d. Sioux Chief Manufacturing Company, Inc.
    e. WATTS.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Precision Plumbing Products.
    c. Zurn Industries, LLC.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Control Valves: Install with inlet and outlet shutoff valves[and bypass with globe valve]. Install pressure gauges on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

D. Nonfreeze, Sanitary Yard Hydrants: Set with riser pipe in concrete or pavement. Do not encase canister in concrete.

E. Water-Hammer Arresters: Install in water piping in accordance with PDI-WH 201.

F. Supply-Type, Trap-Seal Primer Device: 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 valve for proper flow.

G. Drainage-Type, Trap-Seal Primer Device: Install as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 CONTROL CONNECTIONS

A. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

D. Adjust each in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections[with the assistance of a factory-authorized service representative].

1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 PRODUCTS

2.1 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1. Armstrong Pumps, Inc.
2. Bell & Gossett; a Xylem brand.
3. TACO Incorporated.

B. Description: Factory-assembled and -tested, in-line, single-stage, close-coupled, overhung-impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Pump Construction:

1. Casing: Radially split with threaded companion-flange connections for pumps with NPS 2 pipe connections and flanged connections for pumps with NPS 2-1/2 pipe connections.
2. Impeller: Statically and dynamically balanced, closed, and keyed to shaft.
3. Shaft and Shaft Sleeve: Steel shaft with deflector, with copper-alloy shaft sleeve. Include water slinger on shaft between motor and seal.
4. Seal: Mechanical, with carbon-steel rotating ring, stainless-steel spring, ceramic seat, and rubber bellows and gasket.
5. Bearings: Oil-lubricated; bronze-journal or ball type.
6. Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

D. Motor: Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing.

1. Capacities and Characteristics: See Schedule

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

A. Pressure Switches: Electric, adjustable for control of water-supply pump.

1. Type: Water-immersion pressure sensor, for installation in piping.
2. Enclosure: NEMA 250, Type 4X.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 24 V, ac.

B. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 65 to 200 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 24 V, ac.
7. Settings: Start pump at 105 deg F and stop pump at 120 deg F .

C. Timers: Electric, for control of hot-water circulation pump.

1. Type: Programmable, seven-day clock with manual override on-off switch.
2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120-V ac.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install horizontally mounted, in-line, close-coupled centrifugal pumps with shaft(s) horizontal.

D. Install vertically mounted, in-line, close-coupled centrifugal pumps with shaft vertical.

E. Pump Mounting: Install vertically mounted, in-line, close-coupled centrifugal pumps with cast-iron base mounted on concrete base using elastomeric pads. Comply with requirements for concrete base specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

1. Minimum Deflection: 1/4 inch.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.

F. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

G. Install pressure switches in water supply piping.

H. Install thermostats in hot-water return piping.

I. Install timers on wall in engineer's office.

J. Install time-delay relays in piping between water heaters and hot-water storage tanks.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

1. Install pressure gage[and snubber] at suction of each pump and pressure gage[and snubber] at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

E. Connect pressure switches, thermostats, time-delay relays, timers to pumps that they control.

F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hubless, cast-iron soil pipe and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

1.5 WARRANTY

A. Listed 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. Soil, Waste, and Vent Piping: 10-foot head of water.

2. Waste, Force-Main Piping: 50 psig.

2.2 PIPING MATERIALS

A. Piping materials shall 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

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Charlotte Pipe and Foundry Company.

B. Pipe and Fittings: ASTM A 888 or CISPI 301.

C. CISPI, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. MIFAB, Inc.
d. Mission Rubber Company, LLC; a division of MCP Industries.
e. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Charlotte Pipe and Foundry Company.

b. MG Piping Products Company.

2. Standard: ASTM C 1277.
3. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

PART 3 EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 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.
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 sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

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 drain pipe.

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.

K. 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.

L. Install soil and 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. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install steel piping according to applicable plumbing code.

O. Install stainless-steel piping according to ASME A112.3.1 and applicable plumbing code.

P. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

Q. Install aboveground ABS piping according to ASTM D 2661.

R. Install aboveground PVC piping according to ASTM D 2665.

S. Install underground [ABS] [and] [PVC] piping according to ASTM D 2321.

T. Install engineered soil and waste and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Hubless, Single-Stack Drainage System: Comply with ASME B16.45 and hubless, single-stack aerator fitting manufacturer's written installation instructions.
3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

U. Install underground, ductile-iron, force-main piping according to AWWA C600.

1. Install buried piping inside building between wall and floor penetrations and connection to sanitary sewer piping outside building with restrained joints.
2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

1. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

W. Install force mains at elevations indicated.

X. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. 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 force-main piping.
b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

Y. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Z. 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."

AA. 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."

BB. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

G. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

H. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

I. Plastic, Nonpressure-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. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 VALVE INSTALLATION

A. Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping" for general-duty valve installation requirements.

B. Shutoff Valves:

1. Install shutoff valve on each sewage pump discharge.
2. Install gate or full-port ball valve for piping NPS 2 and smaller.
3. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. 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.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for 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.

D. Support horizontal piping and tubing within 12 inches of each fitting[, valve,] and coupling.

E. Support vertical runs of soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect 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.
5. Install horizontal backwater valves [with cleanout cover flush with floor] [in pit with pit cover flush with floor] <Insert description>.
6. Comply with requirements for [backwater valves] [cleanouts] [and] [drains] specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Connect force-main piping to the following:

1. Sanitary Sewer: To exterior force main.
2. Sewage Pump: To sewage pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary 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.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

    a. Isolate test source and allow to stand for four hours.
    b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 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 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.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping [NPS 4 and smaller] <Insert pipe size range> shall be[any of] the following:

1. Hubless, cast-iron soil pipe and fittings[and hubless, single-stack aerator fittings]; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.

C. Aboveground, soil and waste piping [NPS 5 and larger] <Insert pipe size range> shall be[any of] the following:

1. Hubless, cast-iron soil pipe and fittings [and hubless, single-stack aerator fittings]; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.

D. Aboveground, vent piping [NPS 4 and smaller] <Insert pipe size range> shall be[any of] the following:

1. Hubless, cast-iron soil pipe and fittings; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.

E. Aboveground, vent piping [NPS 5 and larger] <Insert pipe size range> shall be[any of] the following:

1. Hubless, cast-iron soil pipe and fittings; [CISPI] [heavy-duty] hubless-piping couplings; and coupled joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, soil, waste, and vent piping [NPS 4 and smaller] <Insert pipe size range> shall be[any of] the following:

1. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; and coupled joints.
2. PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground, soil and waste piping [NPS 5 and larger] <Insert pipe size range> shall be[any of] the following:

1. Hubless, cast-iron soil pipe and fittings; cast-iron hubless-piping couplings; coupled joints.

H. Aboveground sanitary-sewage force mains [NPS 2-1/2 to NPS 6] <Insert pipe size range> shall be[any of] the following:

1. Grooved-end, galvanized-steel pipe; grooved-joint, galvanized-steel-pipe appurtenances; and grooved joints.

I. Underground sanitary-sewage force mains [NPS 4 and smaller] <Insert pipe size range> shall be[any of] the following:

1. Fitting-type transition coupling for piping smaller than NPS 1-1/2 and pressure transition coupling for NPS 1-1/2 and larger if dissimilar pipe materials.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

A. ABS: Acrylonitrile butadiene styrene.

B. PVC: Polyvinyl chloride.

PART 2 PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. WATTS.

2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with threaded access check valve.
6. End Connections: Hub and spigot or hubless.
7. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
8. Extension: ASTM A74, Service Class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. MIFAB, Inc.
    c. WATTS.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Sioux Chief Manufacturing Company, Inc.

2. Standard: ASME A112.36.2M for adjustable housing heavy-duty, adjustable housing threaded, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Threaded.
7. Closure: Cast-iron plug.
8. Adjustable Housing Material: Cast iron with .
9. Riser: ASTM A74, Service Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

    a. Brass Cast iron.
    b. Countersunk or raised head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as or not more than one size smaller than cleanout size.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

B. 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 backwater valves in building drain piping.

1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. 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 soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Assemble open drain fittings and install with top of hub [1 inch] [2 inches] <Insert dimension> above floor.

F. 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.

G. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

H. Install vent caps on each vent pipe passing through roof.

I. Install frost-proof vent caps on each vent pipe passing through roof. Maintain 1-inch clearance between vent pipe and roof substrate.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "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 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping 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 221319.13 - SANITARY DRAINS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Floor drains.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene.

D. PE: Polyethylene.

E. PP: Polypropylene.

F. PVC: Polyvinyl chloride.

PART 2 PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg. Co.
b. MIFAB, Inc.

c. Prier Products, Inc.
d. Sioux Chief Manufacturing Company, Inc.
e. Wade; a subsidiary of McWane Inc.
f. WATTS.
g. Zurn Industries, LLC.

2. Standard: ASME A112.6.3 with backwater valve.
3. Body Material: Gray iron.
4. Outlet: Bottom.
5. Top or Strainer Material: Bronze Stainless steel.
6. Top Shape: Round Square.
7. Trap Material: Cast iron.
8. Trap Pattern: Standard P-trap.
9. Trap Features: Trap-seal primer valve drain connection.

PART 3 EXECUTION

3.1 INSTALLATION

A. 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. Set with grates depressed according to the following drainage area radii:

a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

C. Comply with ASME A112.3.1 for installation of stainless-steel channel drainage systems.

1. Install on support devices, so that top will be flush with adjacent surface.

D. Install FRP channel drainage system components on support devices, so that top will be flush with adjacent surface.

E. Install plastic channel drainage system components on support devices, so that top will be flush with adjacent surface.

F. Install open drain fittings with top of hub 1 inch above floor.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves, air admittance devices and miscellaneous sanitary drainage piping specialties.

C. Comply with requirements in Section 221323 "Sanitary Waste Interceptors" for grease interceptors, grease-removal devices, oil interceptors, sand interceptors, and solid interceptors.

D. Install piping adjacent to equipment to allow service and maintenance.

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."

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping 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 221319.13

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal roof drains.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 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, Medium-Sump, General-Purpose Roof Drains <Insert drawing designation if any>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg Co; a division of Morris Group International.
   b. MIFAB, Inc.
   c. Wade; a subsidiary of McWane Inc.
   d. WATTS.
   e. Zurn Industries, LLC.

2. Standard: ASME A112.6.4.
3. Body Material: Cast iron.
4. Dimension of Body: 8- to 12-inch diameter.
5. Flow-Control Weirs: Not required.
6. Outlet: Bottom.
7. Outlet Type: No hub.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas in accordance with 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 downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.

D. Install downspout nozzles at exposed bottom of conductors where they spill onto grade.

E. Install cleanouts in aboveground piping and building drain piping in accordance with 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 storm piping conductor.

F. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

G. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

H. Install test tees in vertical conductors and near floor.

I. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

J. Assemble channel drainage system components in accordance with manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.

K. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated assemblies.

1. Comply with requirements in Section 078413 "Penetration Firestopping."

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 INSTALLATION OF FLASHING

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

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 221423

SECTION 223200-NON POTABLE WATER MANAGEMENT SYSTEM

PART 1 GENERAL

1.1 This section describes the technical specifications and general information for furnishing factory tested, water management controls and treatment equipment, related to a water system.

1.2 This is a customized and engineered system consisting of several manufactured components to be integrated into an automatic system.

1.3 The water management controls and treatment package system manufacturer is responsible for preparing the skid fabrication drawings and supporting wiring diagrams necessary for installation and integration into the water system. This specification is intended to establish minimum acceptable standards consistent with industry practice.

1.4 Equipment shall meet all applicable codes, with all electrical equipment being UL listed.

1.5 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 01 specification sections, apply to this section.

B. Division 22 - "Plumbing"

1.6 SUMMARY

A. Section Includes:

1. Primary water system pump(s)- also see sequence of operations
2. Primary water pump accessories -also see sample equipment schedule
3. Primary storage level controls - also see sequence of operations
4. Water management controls and treatment package
5. Water secondary storage tank- also see sample equipment schedule
6. Distribution booster pump system- also see sequence of operations
7. Controls system
8. Water quality requirements

B. Additional items to be covered (by Design Engineer).

1. Water distribution piping, valves, and fittings
2. Special piping requirements

1.7 References

A. National Sanitation Foundation (NSF)

B. National Electric Manufacturers Association (NEMA)

C. Occupational Safety and Health Act (OSHA)

D. Underwriters Laboratories (UL)

E. Other Codes as required

1.8 System Description

A. Factory assembled, skid mounted, pre-wired and pre-programmed water management system with filtration, disinfection, on board diagnostics, and any required fully inter-operable building management system (BMS) integration. The system shall be pre-piped, pre-wired, and pre-commissioned at the manufacturing facility, and undergo a Functional Performance Test with associated FAT documentation supplied to owner before system startup. The system shall be capable of predictive modeling and forecasting utilizing current weather forecast data and text analytics. System shall manage tank water volume through algorithm designed to discharge storm water in advance of a precipitation event.

1.9 Quality Assurance

A. System manufacturer shall furnish three (3) years documented experience in manufacturing similar skid mounted controls and equipment.

B. Manufacturer shall have internal water testing lab for determining makeup water quality and conducting water modeling exercises.

C. Water treatment system shall be hydrostatically tested and certified prior to shipment.

D. All programming and controls shall be point to point bench tested for full functionality prior to shipment

E. Electrical components shall be UL and/or DN listed for conformance to standards.

F. Shall have controls engineer and accredited water quality professional on staff at manufacturer

G. Approved Water System Skid Manufacturers:

1. Aquanomix, LLC - Aquanomix.com
2. GE Water - GEWater.com
3. Siemens Water Technologies - Siemens.com

H. 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.

I. Installer shall be responsible for conformance to all local, state and federal installation codes.

J. Unit is to be rated for indoor use only.

1.10 SUBMITTALS

A. Product Data: For factory assembled water management system, include material descriptions, dimensions of skid mounted system, rated electrical draw capacities for individual components, flow, rate electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Detailed equipment assembly drawings, indicating dimensions, weights, required clearances, components, total electrical draw and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring and associated connections.

1.11 START-UP SERVICE

A. The scope of work for the water management system shall include all of the following requirements, as listed below to provide for a complete water management program for the applicable water collection system. This includes all necessary equipment to filter, disinfect, and condition water to be used for Non-potable Cooling Tower uses. In addition, testing, analysis, lab work, and documentation shall be inclusive in this scope of work. All field labor and materials required to install system shall be furnished by installing contractor with the technical direction of the water management package representative. All field piping and start up/installation shall be considered part of the scope of work of the installing contractor. Field wiring shall be responsibility of electrical contractor for all voltage equal to or greater than 120V. All low voltage wiring (<120V) shall be responsibility of controls contractor. Startup service shall include but not be limited to the following:

1. Initial water analysis and subsequent conditioning program setup.
2. Direction for installing contractor to install and start up water management controls and treatment package.
3. Installing contractor shall obtain samples from raw water at beginning of project as well as system effluent after startup and at three consecutive seven-day intervals (total of four samples), and ship to manufacturer lab for water analysis. All samples shall be collected by installing contractor and sent to water management controls and treatment package manufacturer for lab analysis.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. UV: Quantity of (2) - 10,000 hour rated UV lamps matched to system specifications.

PART 2 PRODUCTS

2.1 Manufacturers

A. Acceptable Manufacturers - Storage Tanks:

1. Aquanomix
2. GE Water
3. Siemens Water Technologies

B. Acceptable Manufacturers - Pumps and Pump Skids:

1. Aquanomix
2. GE Water
3. Siemens Water Technologies

C. Acceptable Manufacturers - Controls and Float Switches:

1. Aquanomix
2. GE Water
3. Siemens Water Technologies

D. Acceptable Manufacturers - Rainwater Filters:

1. Aquanomix
2. GE Water
3. Siemens Water Technologies

2.2 Pre-Filter

A. Pre-filtration will be via a Aquanomix AXVF3 rated for 30,000 sqft.

2.3 Cistern

A. Tank shall be a AXXT20000 underground fiberglass tank, designed to hold 20,000 gallons. The tank shall have the following fittings:

1. 6" DIA PVC STRAIGHT PIPE INLET
2. 4" DIA PVC STRAIGHT PIPE OVERFLOW
3. 4" NPT HALF COUPLING FOR RECIRCULATION
4. 24" DIA ACCESS & STRIKR PLATE
5. 24" D X 48" T PVC RSR W/ FRP LID
6. 24" X 24" PUMP PLATEFORM
7. 6" DIA NPT HALF COUPLING FOR VENT
8. 4" DIA NPT FULL COUPLING FOR PUMP DISCARGE
9. 2" DIA NPT HALF COULPING FOR PUMP ELECTRIC
10. 4" D NPT HALF COUPLING FOR SWITCH OR GAGE
11. FRP LADDER 10'

2.4 Skid mounted pump

A. Pump shall be simplex pump designed to deliver design conditions of 40 GPM rated at 100 TDH supplied with appropriate water and proper power source as specified including sufficient amperage, 3 phase, and 460 volts from a dedicated circuit. All electrical connections must meet manufacturer's specifications and meet all compliance requirements and local building codes.

2.5 Level Control System

2.6 Ultrasonic level controller shall be capable of multi-function level control. The sensor shall combine switch, controller, and transmitter. The unit shall be capable of USB integration and programming.

2.7 Booster pump

2.8 Pump shall be simplex cistern pump designed to deliver design conditions of 40 GPM rated at 350 TDH with integral vfd's with pressure sensor when supplied with appropriate water and proper power source as specified including sufficient amperage, 3 phase, and 460 volts from a dedicated circuit. All electrical connections must meet manufacturer's specifications and meet all compliance requirements and local building codes.

2.9 Diaphragm Tank

A. 10.3 gallon non-code Rated to 150 psig

B. Full acceptance

C. Heavy duty butyl rubber bladder

D. Sized by pump manufacturer to meet pump delivery specifications

E. Installed on the pump skid in mechanical room

2.10 Day Tank

2.11 Polyethylene vertical bulk storage tank to be 500 gallons with a diameter of 46 inches and 76 inches tall.

2.12 Level Control System

A. Ultrasonic level controller shall be capable of multi-function level control. The sensor shall combine switch, controller, and transmitter. The unit shall be capable of USB integration and programming.

2.13 Water Meter

A. To be a Aquanomix AXBWM5, ten gallon per pulse 1 1/2 inch turbine rainwater reuse meter to be provided for each point of use.

2.14 Water Treatment Train

A. Equipment Mounting: All equipment listed herein including filtration, water meter(s), other related conditioning equipment, and Main control panel shall be pre-piped, pre-wired and skid mounted. System components shall be mounted on an epoxy coated structural steel base. All piping shall be Schedule 80 PVC, unless otherwise noted in drawings, specifications, and/or as indicated by codes. Inlet and outlet of skid mounted station shall include NPT piping connections. All skid mounted system equipment shall be rated for design flow conditions as per sample equipment schedule at end of section.

B. Aquanomix AXCS3 centripetal separator, particulate removal efficiencies of 98% at 50 microns or larger with a flow rate of 40 GPM.

C. Aquanomix AXBF1 Sand Filter housing to be 304 stainless steel Designed for 150 PSI, protective poly coat over stainless steel, band clamp for easy access and bag changing.

D. Aquanomix AXUVV6 Ultraviolet Light - 100 psi, 120 VAC, 230 Watts, Cooltouch fan, sensor with diagnostic test, 316 SST, Communication ports, Audible alarm mute button, Lamp operation indicator, Solenoid operation indicator, and Fan operation indicator.

E. AQUANOMIX AXP Series Conductivity Sensor- Graphite measuring surfaces, Available with or without ATC(temperature sensor), Easy-to-use fitting for in-line mounting.

F. AQUANOMIX AXP ORP Series Sensor- Body Material of CPVC, range of +/- 2000mV.

G. AQUANOMIX AXP pH Series Sensor- Body Material of CPVC, range of 0-14pH (0-12pH without Na+ error.

H. AQUANOMIX AX3WV Recirculation Valve- Three way solenoid to be place after the analytical probes to re-circulate the tank water when there is no demand to meet.

I. Before shipping, hydrostatically test skid mounted system; all electrical and mechanical components should be tested for proper functional operation. A certificate of conformance shall be provided at time of shipment.

2.15 MAIN CONTROL SYSTEM:

A. Controls:

1. Aquanomix -CT rated for 40 GPM or approved equal main control system must be capable of any required integration into building management system to provide a fully functioning, programmable, automatic water management program. Any required Controls system integration protocol shall be determined by specifying engineer. Reference controls section for further information.
2. System shall be capable of predictive modeling and forecasting, utilizing current weather forecast data and text analytics. System shall manage tank water volume through algorithms designed to discharge storm water in advance of a precipitation event.
3. The Main control cabinet shall be NEMA 3R Rated and shall have a main power switch with incoming power disconnect.
4. The Main control system cabinet shall be UL listed. The Main control system cabinet shall have all required conduit, fuses, relays, transmitters, transformers, circuit breakers and dry contacts for a fully functioning system and incorporate the following components:

5. Building Automation System (BAS) Based Controller
6. BAS Communications Module shall be non-proprietary, Windows based and communicate the following from a single point communication from controller to main BAS system

    a. All alarms including water quality inputs including pH, Conductivity, and ORP.

        1) pH probe shall be 0-14, body made of rigid PVC
        2) ORP probe shall be +/- 2000 mv, made of rigid PVC
        3) Conductivity probe shall be graphite, with automatic temperature compensation

    b. Active storm water tank management: System shall be capable of predictive modeling and forecasting, utilizing current weather forecast data imported from NWS. System shall manage tank water volume through algorithms designed to discharge storm water in advance of a precipitation event, during dry weather events.

        1) Ventilated enclosure

    c. Touchscreen Windows 8 Tablet interface with 10.1" display
    d. Controller shall be capable of recording system at defined intervals

        1) Software

    e. Real-time water quality measurement and verification, with ability to change water quality to produce suitable makeup water to cooling tower

7. The Main control system for the water management system shall be capable of controlling the following:
8. INTEGRATION WITH COOLING TOWER WATER MANAGEMENT CONTROLLER

B. To effectively minimize scale, corrosion and microbial growth, controls must be integrated to the cooling tower water management controller specified in Section 232500 - "HVAC WATER TREATMENT".

1. Controller shall send water quality outputs to the cooling tower water management controller.
2. Controller shall receive start / stop commands from cooling tower water management controller.
3. Controller shall send instantaneous disinfection alarm indication to the cooling tower water management controller.
4. NPW
5. Interface between HVAC water management controller and Non-Potable water management controller
6. Virtual communications shall be capable to transmit pH, ORP, Conductivity, ReUse water meter flow, UV Fail alarm, Filter fouled alarm and other key data from Non-Potable water management controller via Modbus TCP/IP over Ethernet protocol to the HVAC water management controller.
7. Virtual communications shall be capable to transmit City Water flow, HVAC water quality parameters and alarms, as well as other key data from the HVAC water management controller via Modbus TCP/IP over Ethernet protocol to the Non-Potable water management controller.

8. Virtual communications shall be capable to transmit HVAC water quality parameters and alarms as well as other key data from Non-Potable water management controller via Modbus TCP/IP over Ethernet protocol to the HVAC water management controller.
9. Class II copper conductor technology pulse technology shall transmit City water flow meter and other key data from the City water flow meter to the HVAC water management controller.
10. Class II copper conductor technology shall be capable to transmit pH, ORP, Conductivity, ReUse water meter flow, UV Fail alarm, Filter fouled alarm and other key data from Non-Potable water management controller via cables and or wires to the HVAC water management controller.
11. Class II copper conductor technology shall be capable to transmit City Water flow, HVAC water quality parameters and alarms, as well as other key data from the HVAC water management controller via cables and or wires to the Non-Potable water management controller.
12. Class II copper conductor technology shall be capable to transmit HVAC water quality parameters and alarms as well as other key data from Non-Potable water management controller via cables and or wires to the HVAC water management controller.

C. Reference HVAC water management controller Matrix sequence of operations content

1. HVAC water management controller to switch inhibitor delivery based on water source.
2. HVAC water management controller to switch bleed based set point based on water source.
3. The Main control system for the water management system shall be capable of controlling the following:
4. See operational system matrix at end of section

PART 3 EXECUTION

3.1 EXAMINATION

A. Installing contractor shall be responsible for performing the following:

1. Roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
2. Examine walls and floors for suitable conditions where skid mounted systems will be installed.
3. Proceed with installation only after unsatisfactory conditions have been corrected.
4. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of skid mounted system, as indicated in submittal package.

3.2 CONNECTIONS

A. Comply with requirements for Non-potable domestic water piping. Drawings indicate general arrangement of piping, fittings, and specialties. Consult local state and federal building codes for additional information.

B. Installation of equipment shall allow for proper service and maintenance.

C. Where applicable, make piping connections between dissimilar-metals with dielectric fittings. Comply with requirements for dielectric fittings specified in Division 22 Section "Domestic Water Piping."

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 QUALITY CONTROL

A. System shall include pH, Conducitivty, and ORP probes at a minimum. All parameters shall be set in accordance with water quality guidelines as set forth by cooling tower manufacturer for suitability for makeup water to system.

B. Pre-commissioning test at factory with accompanying documentation of Functional Acceptance Test shall be required

C. Manufacturer Tests and Inspections:

1. Hydrostatic Test: After installation, charge system to 1.5x system operating pressure and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation, including analog and digital I/O.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Optional: Engineer witness test via remote internet connection.

D. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain water collection system. Startup and training shall be made part of this contract.

3.6 Warranty

A. System shall be warranted for 18 months from date of shipment or 12 months from startup, whichever one comes first.

B. SEQUENCE OF OPERATIONS

Separator	**Material of Construction:**	Carbon Steel
	Connection:	1 1/2" MPT
	Purge:	3/4" FPT

	Dimensions:	13"x45"x12"
Filter Housing	**Material of Construction:**	304 Stainless Steel
	Connection:	1 1/4" FNPT
	Drain:	1/2" NPT
	Vent:	1/4" NPT
	Closure:	Clamp
	Dimensions:	15.5"x48"
	Clearance Requirements:	48" clearance from top for filter change
	Additional Requirements:	1) Differential pressure gauge with physical read out display and dry contact relay to Main control system. Trip point 15 psi.
UV Disinfection	**Material of Construction:**	316L stainless steel
	Connection:	1 1/4" FNPT
	Electrical Requirements:	120V
	Number of Lamps/Quick Disconnects	2
	Dimensions:	6" x 46" long
	Lamp Output:	60mJ/cm2 to achieve a 3 log reduction at 254 nm.
	Clearance Requirements:	33" clearance from top for lamp exchange
	Additional Requirements:	1) UV light intensity indicator wired to Main control sys-tem 2) Run time meter wired to Main control system
Electric Actuator	**Material of Construction:**	Brass bar stock body with 316 stainless steel ball and

		stem.
	Connection:	1" FNPT
	Electrical Requirements:	120V
Turbine Water Meter	**Meter Body:**	Cast Bronze body, engineered thermoplastic internals, alnico magnet
	Connection:	2.0" NPT
	Electrical Requirements:	Dry contact - Reed switch
	Additional Requirements:	Pulse Rate of 10 Gal/Pulse
	Additional Requirements:	Pulse Rate of 10 Gal/Pulse

END OF SECTION 223200

SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Electric, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Five years.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

D. Commercial, Electric, Storage, Domestic-Water Heaters:

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. A. O. Smith Corporation.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 1453.
4. Storage-Tank Construction: ASME-code, steel vertical arrangement.

    a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

        1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.

    b. Pressure Rating: 150 psig.
    c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
    d. Anode Rod: Replaceable magnesium.
    e. Drain Valve: Corrosion-resistant metal with hose-end connection.
    f. Insulation: Comply with ASHRAE/IES 90.1.
    g. Jacket: Steel with enameled finish or high-impact composite material.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
    j. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

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. A. O. Smith Corporation.

2. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
3. Description: Steel pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
4. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Air-Charging Valve: Factory installed.
    c. Working-Pressure Rating: 100 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with ASHRAE/IES 90.1.

D. Heat-Trap Fittings: ASHRAE/IES 90.1.

E. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- maximum outlet pressure unless otherwise indicated.

F. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

G. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.

I. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

J. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of [18 inches] <Insert dimension> above the floor.

K. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test[commercial] domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.

4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

I. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

J. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."

K. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

L. Fill electric, domestic-water heaters with water.

M. Charge domestic-water expansion tanks with air to required system pressure.

N. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections[with the assistance of a factory-authorized service representative].

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters. Training shall be a minimum of two hour(s).

END OF SECTION 223300

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor-mounted, bottom-outlet water closets.
2. Floor-mounted, back-outlet water closets.
3. Wall-mounted water closets.
4. Flushometer valves.
5. Supports.

1.2 DEFINITIONS

A. Standard-Efficiency Flush Volume: 1.6 gal. per flush.

B. High-Efficiency Flush Volume: 1.28 gal. or less per flush.

C. WaterSense Fixture: Water closet and/or flushometer valve/tank certified by the EPA to meet the WaterSense performance criteria.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves[and electronic sensors] to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Materials: Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Comply with ASME A112.19.2/CSA B45.1 for water closets.
2. Comply with ASME A112.19.5/CSA B45.15 for flush valves and spuds for water closets and tanks.
3. Comply with ASSE 1037/ASME A112.1037/CSA B125.37 for flush valves.
4. Comply with IAMPO/ANSI Z124.5 for water-closet (toilet) seats.
5. Comply with ASME A112.6.1M for water-closet supports.
6. Comply with ICC A117.1 for ADA-compliant water closets.
7. Comply with ASTM A1045 for flexible PVC gaskets used in connection of vitreous china water closets to sanitary drainage systems.
8. Comply with ASME A112.4.3 for plastic fittings used in connection of vitreous china water closets to sanitary drainage systems.

2.2 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets - Floor Mounted, Bottom Outlet, Top Spud: Refer to Plumbing Schedule for selection

1. Source Limitations: Obtain water closets from single source from single manufacturer.
2. Water Closet to support 1.0 gpf

2.3 WALL-MOUNTED WATER CLOSETS

A. Water Closets - Wall Mounted, Top Spud: Refer to Plumbing Schedule for selection

1. Source Limitations: Obtain water closets from single source from single manufacturer.
2. Water Closet to support 1.0 gpf

2.4 SUPPORTS

A. Water-Closet Carrier:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. MIFAB, Inc.
c. WATTS.
d. Zurn Industries, LLC.

2. Source Limitations: Obtain water-closet carrier from single source from single manufacturer.

3. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:

1. Install level and plumb.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height in accordance with ICC A117.1.

B. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations easily reachable for people with disabilities.
5. Install new batteries in battery-powered, electronic-sensor mechanisms.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate to be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate to be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least [1/2 inch] <Insert dimensions> high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.6 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.7 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Enameled, cast-iron, counter-mounted lavatories.
2. Vitreous-china, counter-mounted lavatories.
3. Enameled, cast-iron, wall-mounted lavatories.
4. Vitreous-china, wall-mounted lavatories.
5. Supply fittings.
6. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.5 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. Faucet Washers and O-Rings: Equal to [10] <Insert number> percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to [5] <Insert number> percent of amount of each type and size installed.

PART 2 PRODUCTS

2.1 ENAMELED, CAST-IRON, COUNTER-MOUNTED LAVATORIES

A. Refer to Plumbing Schedule for Selection:

1. Provide faucet at 0.35gpm or less to meet LEED criteria

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Refer to Plumbing Schedule for Selection:

1. Provide faucet at 0.35gpm or less to meet LEED criteria

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.

C. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

2.4 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/4.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least [1/2 inch] <Insert dimension> high.

3.5 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13