

1 **SECTION 22 01 00 - GENERAL PROVISIONS FOR PLUMBING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

- 4 A. Drawings and general provisions of the Contract, including General and Supplementary
5 Conditions and Division 01 Specification Sections, apply to this Section.
- 6 B. Provisions of this Section apply to all Division 22 Specification Sections.

7 **1.2 SUMMARY**

- 8 A. Section includes basic requirements for plumbing systems.
- 9 B. Related Work:
- 10 1. Division 03 – Concrete
- 11 a. Refer to Division 03 for rough grouting in and around work, patching concrete cut
12 to accommodate work, and sumps for work.
- 13 b. Comply with the requirements of Division 03 for curbs, foundations, inertia bases,
14 and equipment pads for equipment.
- 15 2. Division 05 – Metals
- 16 a. Refer to Division 05 for framed openings for equipment.
- 17 b. Comply with the requirements of Division 05 for supports for work.
- 18 3. Division 06 – Wood, Plastics, and Composites
- 19 a. Refer to Division 06 for framed openings for equipment.
- 20 4. Division 07 – Thermal and Moisture Protection
- 21 a. Refer to Division 07 for installation of roof curbs and roof supports and for caulking
22 and waterproofing of wall- and roof-mounted work.
- 23 b. Comply with the requirements of Division 07 for penetration firestopping and
24 furnishing roof curbs and roof supports for equipment and piping.
- 25 5. Division 08 – Openings
- 26 a. Refer to Division 08 for installation of access doors and frames.
- 27 b. Comply with the requirements of Division 08 for access doors and frames, unless
28 otherwise included in the Contract Documents.
- 29 6. Division 09 – Finishes
- 30 a. Refer to Division 09 for paint products and applications in finished spaces.
- 31 b. Comply with the requirements of Division 09 for paint products and applications
32 identified in the Contract Documents.
- 33 7. Division 10 – Specialties
- 34 a. Refer to Division 10 for fire protection cabinets and fire extinguishers.
- 35 8. Division 11 – Equipment
- 36 a. Refer to Division 11 for food service equipment to be provided.

- 1 b. Comply with the requirements of Division 11 for connections and related devices to
2 make these systems operational.

- 3 9. Division 21 – Fire Suppression
- 4 a. Refer to Division 21 for all suppression work.

- 5 10. Division 23 – Heating, Ventilation, and Air-Conditioning
- 6 a. Refer to Division 23 for all heating, ventilation, and air-conditioning work.
- 7 b. Comply with requirements of Division 23 for related equipment and components
8 and for connections to systems.

- 9 11. Division 25 – Instrumentation and Control
- 10 a. Refer to Division 25 for instrumentation and control systems.
- 11 b. Comply with the requirements of Division 25 for installation of and integration with
12 instrumentation and control components.

- 13 12. Division 26 – Electrical
- 14 a. Refer to Division 26 for all electrical work.

- 15 13. Division 27 – Communications
- 16 a. Refer to Division 27 for all communications work.

- 17 14. Division 28 – Electronic Safety and Security
- 18 a. Refer to Division 28 for all electronic safety and security work.
- 19 b. Coordinate with Division 28 for integration with fire-alarm systems.

- 20 15. Division 31 – Earthwork
- 21 a. Refer to Division 31 for all site related work greater than five feet outside the
22 building, unless noted otherwise in the Contract Documents.
- 23 b. Comply with the requirements of Division 31 for site clearing, earth moving, and
24 dewatering within five feet outside the building and otherwise as indicated in the
25 Contract Documents.

- 26 16. Division 33 – Utilities
- 27 a. Refer to Division 33 for all utility related work greater than five feet outside the
28 building, unless noted otherwise in the Contract Documents.
- 29 b. Comply with the requirements of Division 33 for utility work within five feet outside
30 the building and otherwise as indicated in the Contract Documents.

31 **1.3 DEFINITIONS**

- 32 A. Experienced: When used with an entity or individual, “experienced” unless otherwise further
33 described means having successfully completed a minimum of five previous projects similar in
34 nature, size, and extent to this Project; being familiar with special requirements indicated; and
35 having complied with requirements of authorities having jurisdiction.

- 36 B. Furnish: Supply and deliver to project site, ready for subsequent requirements.

- 37 C. Provide: Furnish and install, complete and ready for intended use.

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

- 1 E. Patching: Fitting and repair work required to restore construction to original conditions after
2 installation of subsequent work.
- 3 F. Concealed Work: Work hidden from view, including inside chases, furred spaces, or above
4 ceilings.
- 5 G. Exposed Work: Work open to view, including inside mechanical and equipment rooms and on
6 mezzanines.

7 **1.4 QUALITY ASSURANCE**

- 8 A. General:
 - 9 1. It is the intent of the plans and specifications to obtain a complete, operable and
10 satisfactory installation.
 - 11 2. All materials shall be new, be properly labeled and/or identified and be in full compliance
12 with the contract documents.
 - 13 3. All work shall comply with applicable Codes and Standards.
 - 14 4. Manufacturer's model names and numbers used in these specifications are subject to
15 change per manufacturer's action. Contractor shall therefore verify them with
16 manufacturer's representative before ordering any product or equipment
- 17 B. Furnish new and unused materials and equipment manufactured in the U.S.A. Where two or
18 more units of the same type or class of equipment are required provide units of a single
19 manufacturer.

20 **1.5 CODES AND STANDARDS**

- 21 A. Perform work in accordance with the following codes and any applicable statutes, ordinances,
22 codes, and regulations of governmental authorities having jurisdiction.
 - 23 1. ASHRAE
 - 24 a. Standard 90.1 Energy Standard for Buildings Except Low Rise Residential
25 Buildings
 - 26 2. ASME
 - 27 a. Boiler and Pressure Vessel Code - 2013
 - 28 1) Section I Rules for Construction of Power Boilers
 - 29 2) Section IV Rules for Construction of Heating Boilers
 - 30 3) Section VIII Rules for Construction of Pressure Vessels
 - 31 b. ASME A17.1 Safety Code for Elevators and Escalators - 2016
 - 32 c. ASME A17.3 Safety Code for Existing Elevators and Escalators - 2015
 - 33 3. Occupational Safety and Health Regulations (OSHA).
 - 34 4. National Fire Codes
 - 35 a. NFPA 1 Uniform Fire Code – 2018 (Florida Edition)
 - 36 b. NFPA 30 Flammable and Combustible Liquids Code - 2018
 - 37 c. NFPA 54 National Fuel Gas Code – 2018

1 **1.7 DELEGATED-DESIGN SERVICES**

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

5 **1.8 PERMITS FEES AND INSPECTIONS**

6 A. Obtain and pay for all permits, fees, tap fees, connection charges, demand charges, systems
 7 charges, impact fees, and inspections.

8 B. Deliver all certificates of inspection issued by authorities having jurisdiction to the Engineer.

9 **1.9 CONFLICTING REQUIREMENTS**

10 A. Conflicting Standards and Other Requirements: If compliance with two or more standards or
 11 requirements are specified and the standards or requirements establish different or conflicting
 12 requirements for minimum quantities or quality levels, comply with the most stringent
 13 requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer
 14 for direction before proceeding.

15 1. If discrepancies or conflicts occur between drawings, or between drawings and
 16 specifications, notify the Engineer in writing prior to bid date; however, the most stringent
 17 requirement shall govern.

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

24 **1.10 SUBMITTALS**

25 A. Submittals (including Product Data, Shop Drawings, and any other Action Submittal or
 26 Information Submittal) will only be reviewed if they are submitted in full accordance with the
 27 General and Supplementary Conditions, Division 01, and the following:

- 28 1. Prepare and submit submittals required by individual Specification Sections. Types of
 29 submittals are indicated in individual Specification Sections.
- 30 2. Submit all submittal items required for each Specification Section concurrently unless
 31 partial submittals for portions of the Work are approved by the Engineer.
- 32 3. Submittals shall only contain relevant product data. Remove or strikeout irrelevant
 33 product data.
- 34 4. Prepare submittals as PDF electronic files and electronically transmit to Engineer through
 35 email or web-based project software site, in accordance with Division 01 Specification
 36 Sections. Submittals shall be in searchable PDF format and not a scanned copy.
- 37 5. Options: Identify options requiring selection by Engineer.
- 38 6. Deviations: Clearly identify deviations from requirements in the Contract Documents,
 39 including minor variations and limitations.

- 1 B. Substitution Requests shall include, at a minimum:
- 2 1. Statement indicating why specified material, equipment, or installation method cannot be
3 provided, if applicable.
- 4 2. Coordination of information, including a list of changes and revisions needed to other
5 parts of the Work and to construction performed by Owner and separate contractors that
6 will be necessary to accommodate proposed substitution.
- 7 3. Detailed comparison of significant qualities of proposed substitutions with those of the
8 Work specified. Include an annotated copy of applicable Specification Section. Significant
9 qualities may include attributes, such as performance, weight, size, durability, visual
10 effect, sustainable design characteristics, warranties, and specific features and
11 requirements indicated. Indicate deviations, if any, from the Work specified.
- 12 4. Product Data, including drawings and descriptions of products and fabrication and
13 installation procedures.
- 14 5. Detailed comparison of Contractor's construction schedule using proposed substitutions
15 with products specified for the Work, including effect on the overall Contract Time. If
16 specified product or method of construction cannot be provided within the Contract Time,
17 include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of
18 purchase order, lack of availability, or delays in delivery.
- 19 6. Cost information, including a proposal of change, if any, in the Contract Sum.
- 20 7. Contractor's certification that proposed substitution complies with requirements in the
21 Contract Documents, except as indicated in substitution request, is compatible with
22 related materials and is appropriate for applications indicated.
- 23 8. Contractor's waiver of rights to additional payment or time that may subsequently become
24 necessary because of failure of proposed substitution to produce indicated results.
- 25 C. Procurement Substitution Requests submitted prior to receipt of bids will be received and
26 considered by Owner when the following conditions are satisfied, as determined by Engineer;
27 otherwise, requests will be returned without action:
- 28 1. Requests for substitution of materials and equipment are received no later than 10 days
29 prior to date of bid opening.
- 30 2. Extensive revisions to the Contract Documents are not required.
- 31 3. Proposed changes are in keeping with the general intent of the Contract Documents,
32 including the level of quality of the Work represented by the requirements therein.
- 33 4. The request is fully documented and properly submitted.
- 34 D. Substitutions for Cause, as required due to changed Project conditions, such as unavailability of
35 product, regulatory changes, or unavailability of required warranty terms will be received and
36 considered by Engineer, only when the following conditions are satisfied; otherwise, requests
37 will be returned without action, except to record noncompliance with these requirements:
- 38 1. Requested substitution is consistent with the Contract Documents and will produce
39 indicated results.
- 40 2. Substitution request is fully documented and properly submitted.
- 41 3. Requested substitution has received necessary approvals of authorities having
42 jurisdiction.
- 43 4. Requested substitution is compatible with other portions of the Work.
- 44 5. Requested substitution has been coordinated with other portions of the Work.
- 45 6. Requested substitution provides specified warranty.
- 46 7. If requested substitution involves more than one contractor, requested substitution has
47 been coordinated with other portions of the Work, is uniform and consistent, is compatible
48 with other products, and is acceptable to all contractors involved.
- 49 E. Substitutions for Convenience, not required in order to meet other Project requirements but may
50 offer advantage to Contractor or Owner, will be received and considered by Owner, as

1 determined by Engineer, only when the following conditions are satisfied; otherwise, requests
 2 will be returned without action, except to record noncompliance with these requirements:

- 3 1. Requested substitution is received within 60 days after the Notice of Award.
- 4 2. Requested substitution offers Owner a substantial advantage in cost, time, energy
 5 conservation, or other considerations, after deducting additional responsibilities Owner
 6 must assume. Owner's additional responsibilities may include compensation to Engineer
 7 for redesign and evaluation services, increased cost of other construction by Owner, and
 8 similar considerations.
- 9 3. Requested substitution does not require extensive revisions to the Contract Documents.
- 10 4. Requested substitution is consistent with the Contract Documents and will produce
 11 indicated results.
- 12 5. Substitution request is fully documented and properly submitted.
- 13 6. Requested substitution has received necessary approvals of authorities having
 14 jurisdiction.
- 15 7. Requested substitution is compatible with other portions of the Work.
- 16 8. Requested substitution has been coordinated with other portions of the Work.
- 17 9. Requested substitution provides specified warranty.
- 18 10. If requested substitution involves more than one contractor, requested substitution has
 19 been coordinated with other portions of the Work, is uniform and consistent, is compatible
 20 with other products, and is acceptable to all contractors involved.

21 F. If a requested substitution is approved but contains differences or omissions not specifically
 22 identified to the attention of the Engineer in the substitution request, the Owner reserves the
 23 right to require equal or similar features to be added to the substituted products or to have the
 24 substituted products replaced at the Contractor's expense.

25 **1.12 PROJECT RECORD DOCUMENTS**

26 A. Recording: Maintain one copy of the Contract Documents and Shop Drawings during the
 27 construction period for project record document purposes. Post changes and revisions to
 28 project record documents as they occur; do not wait until end of Project.

29 B. Preparation:

- 30 1. Contract Drawings and Shop Drawings:
 - 31 a. Mark revisions to show where the actual installation varies from that shown
 32 originally.
 - 33 b. Mark record sets completely and accurately, including important information that
 34 was either shown schematically or omitted from original Drawings.
 - 35 c. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish
 36 between changes for different categories of the Work at same location.
 - 37 d. Record underground and under-slab piping installed, dimensioning exact location
 38 and elevation of piping.
- 39 2. Mark Specifications to indicate the actual product installation where installation varies
 40 from that indicated in Specifications, addenda, and contract modifications.
- 41 3. Mark Product Data to indicate the actual product installation where installation varies
 42 substantially from that indicated in Product Data submittal.

43 C. Deliver: Prior to Final Completion, provide record documents to Owner as indicated below:

- 1 1. Record Drawings: Submit PDF electronic files of scanned record prints and one set of
- 2 prints.
- 3 2. Record Specifications: Submit annotated PDF electronic files of Project's Specifications,
- 4 including addenda and contract modifications.
- 5 3. Record Product Data: Submit annotated PDF electronic files and directories of each
- 6 submittal.
- 7 4. Miscellaneous Record Submittals: Submit annotated PDF electronic files directories of
- 8 each submittal.

9 **1.13 OPERATION AND MAINTENANCE MANUALS**

- 10 A. Prepare and submit a comprehensive manual of emergency, operation, and maintenance data
- 11 and materials in full accordance with the General and Supplementary Conditions, Division 01,
- 12 and the following:
 - 13 1. Operations and Maintenance Manuals: Assemble a complete set of data indicating
 - 14 operation and maintenance of each system, subsystem, and piece of equipment not part
 - 15 of a system, including:
 - 16 a. Information required for daily operation and management, operating standards,
 - 17 and routine and special operating procedures.
 - 18 b. Manufacturers' maintenance documentation, preventative maintenance
 - 19 procedures and frequency, repair procedures, wiring and systems diagrams, list of
 - 20 spare parts, and warranty information.
 - 21 2. Submit manuals as PDF electronic files and electronically transmit to Engineer through
 - 22 email or web-based project software site, in accordance with Division 01 Specification
 - 23 Sections. Submittals shall be in searchable PDF format and not a scanned copy.

24 **1.14 DEMONSTRATION AND TRAINING**

- 25 A. Prepare and provide services of qualified instructors to instruct Owner's personnel to adjust,
- 26 operate, and maintain systems, subsystems, and equipment not a part of a system in
- 27 accordance with the General and Supplementary Conditions, Division 01, individual
- 28 Specification Sections, and the following:
 - 29 1. Demonstration and training shall occur upon completion of the Work and at a time
 - 30 designated by the Owner's representative.
 - 31 2. Provide a high-resolution, digital video recording of each training session to the Owner.

32 **1.15 DELIVERY, STORAGE, AND HANDLING**

- 33 A. Deliver, store, and handle products using means and methods that will prevent damage,
- 34 deterioration, and loss, including theft and vandalism. Comply with manufacturer's written
- 35 instructions.
- 36 B. Inspect products on delivery to determine compliance with the Contract Documents and to
- 37 determine that products are undamaged and properly protected.

38 **1.16 WARRANTY**

1 A. Warranty work and equipment within specified warranty period. During the warranty period,
2 provide labor and materials to make good any faults or imperfections that may arise due to
3 defects or omissions in materials or workmanship without expense to the Owner.

4 1. Warranty Period: One year from date of Substantial Completion.

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

9 C. Owner reserves the right to make emergency repairs as required to keep equipment in
10 operation without voiding Contractor's Guarantee Bond nor relieving the Contractor of
11 responsibilities during the warranty period.

12 **PART 2 - PRODUCTS (NONE)**

13 **PART 3 - EXECUTION**

14 **3.1 CONTRACT DOCUMENTS**

15 A. Examine all drawings and specifications carefully before submitting a bid. Architectural
16 drawings take precedence over mechanical or electrical drawings with reference to building
17 construction.

18 B. For purposes of clearness and legibility, drawings are essentially diagrammatic and, although
19 size and location of equipment are drawn to scale wherever possible, Contractor shall make
20 use of all data in all of the contract documents and shall verify this information at the building
21 site.

22 C. The drawings indicate required size and points of termination of pipes, conduits, and ducts and
23 suggest proper routes to conform to structure avoid obstructions and preserve clearances.
24 However, it is not intended that drawings indicate all necessary offsets, and it shall be the
25 responsibility of the Contractor to make the installation in such a manner as to conform to
26 structure, avoid obstructions, preserve headroom and keep openings and passageways clear,
27 without further instructions or cost to the Owner.

28 D. Furnish, install and/or connect with appropriate services all items shown on any drawing without
29 additional compensation.

30 E. Any and all questions about a subcontractor's scope of work responsibility shall be addressed
31 to and answered by the General Contractor / Construction Manager.

32 F. Questions About Construction Documents: Any and all questions shall be submitted through
33 the proper channels IN WRITING and, in turn, shall be answered by the Engineer in writing. All
34 telephone conversations shall be considered unofficial and, as such, shall not be considered
35 official or binding responses to Contractor's questions.

36 G. Drawings, specifications, or other documents issued by the Engineer in electronic format and/or
37 electronic media are provided for convenience only and are not intended for use as Contract
38 Documents.

- 1 1. The electronic files are provided merely as a convenience to the Recipient.
- 2 2. The electronic files do not replace or supplement the paper copies of any drawings,
3 specifications, or other documents included in the Contract Documents for use on the
4 project.
- 5 3. The Engineer makes no representation, warranty, or guarantee that electronic files:
 - 6 a. Are suitable for any other usage or purpose.
 - 7 b. Have any particular durability.
 - 8 c. Will not damage or impair the Recipient's computer or software.
 - 9 d. Contain no errors or mechanical flaws or other discrepancies that may render them
10 unsuitable for the purpose intended by the Recipient.
- 11 4. Due to the unsecured nature of the electronic files and the inability of Engineer or the
12 Recipient to establish controls over their use, the Engineer assumes no responsibility for
13 any consequences arising out of the use of the data. It is the sole responsibility of the
14 Recipient to check the validity of all information contained therein. The Recipient shall at
15 all times refer to the signed and sealed drawings, specification or other documents for the
16 project during all phases of the project. The Recipient shall assume all risks and liabilities
17 resulting from the use of the electronic files.

18 3.2 SUPERVISION OF WORK

- 19 A. Perform all work under the direct supervision of an experienced, qualified superintendent. The
20 Engineer has the right to remove a superintendent who, in the Engineer's opinion, is not
21 satisfactory.

22 3.3 EXAMINATION

- 23 A. Existing Conditions: The existence and location of underground and other utilities and
24 construction indicated as existing are not guaranteed. Before beginning sitework, investigate
25 and verify the existence and location of underground utilities, mechanical and electrical
26 systems, and other construction affecting the Work.
- 27 B. Examination and Acceptance of Conditions: Before proceeding with each component of the
28 Work, examine substrates, areas, and conditions, with Installer or Applicator present where
29 indicated, for compliance with requirements for installation tolerances and other conditions
30 affecting performance.
 - 31 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of
32 connections before equipment and fixture installation.
 - 33 2. Examine walls, floors, and roofs for suitable conditions where products and systems are
34 to be installed.
 - 35 3. Verify compatibility with and suitability of substrates, including compatibility with existing
36 finishes or primers.
- 37 C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding
38 with the Work indicates acceptance of surfaces and conditions.

39 3.4 PREPARATION

- 1 A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or
2 relocate existing utility structures, lines, services, or other utility appurtenances located in or
3 affected by construction. Coordinate with authorities having jurisdiction.
- 4 B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck
5 measurements before installing each product. Where portions of the Work are indicated to fit to
6 other construction, verify dimensions of other construction by field measurements before
7 fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the
8 Work.
- 9 C. Space Requirements: Verify space requirements and dimensions of items shown
10 diagrammatically on Drawings.
- 11 D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for
12 clarification of the Contract Documents caused by differing field conditions outside the control of
13 Contractor, submit a request for information to Engineer.
- 14 E. Interruption of Service: Before any existing equipment or system is shut down for disconnecting or
15 tie-ins, coordinate with Engineer and Owner regarding acceptable dates and times for this
16 Work to be performed. Work shall be performed at the time best suited for the Owner, which
17 typically is either on weekends, holidays, and/or after normal working hours. Services shall be
18 restored the same day unless prior arrangements are made. All overtime or premium costs
19 associated with this Work shall be included in the Contractor's bid.

20 **3.5 INSTALLATION**

- 21 A. Install materials and equipment in a professional manner. The Engineer may direct
22 replacement of items which, in the Engineer's opinion, do not present a professional
23 appearance or do not allow adequate space for maintenance. Replace or reinstall items at the
24 expense of the Contractor.
- 25 B. General: Locate the Work and components of the Work accurately, in correct alignment and
26 elevation, as indicated.
 - 27 1. Make vertical work plumb and make horizontal work level.
 - 28 2. Where space is limited, install components to maximize space available for maintenance
29 and ease of removal for replacement.
 - 30 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 31 4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and
32 90 inches (2300 mm) in unoccupied spaces.
- 33 C. Comply with manufacturer's written instructions and recommendations for installing products in
34 applications indicated.
- 35 D. Install products at the time and under conditions that will ensure the best possible results.
36 Maintain conditions required for product performance until Substantial Completion.
- 37 E. Conduct construction operations so no part of the Work is subjected to damaging operations or
38 loading in excess of that expected during normal conditions of occupancy.
- 39 F. Sequence the Work and allow adequate clearances to accommodate movement of construction
40 items on site and placement in permanent locations.
- 41 G. Obstructions

- 1 1. The drawings indicate certain information pertaining to surface and subsurface
 2 obstructions which has been taken from available drawings. Such information is not
 3 guaranteed, however, as to accuracy of location or complete information.
 4 2. Before any cutting or trenching operations are begun, verify with Owner's representative,
 5 utility companies, municipalities, and other interested parties that all available information
 6 has been provided. Verify locations given.
 7 3. Should obstruction be encountered, whether shown or not, alter routing of new work,
 8 reroute existing lines, remove obstruction where permitted, or otherwise perform
 9 whatever work is necessary to satisfy the purpose of the new work and leave existing
 10 services and structures in a satisfactory and serviceable condition.
 11 4. Assume total responsibility for and repair any damage to existing utilities or construction,
 12 whether or not such existing facilities are shown.
- 13 H. Where "rated" walls, floor, roofs and ceilings are penetrated or cut to install equipment,
 14 materials, devices, etc. the Contractor shall provide and install all materials required to re-
 15 establish the rating of the wall, floor, roof, or ceiling to the satisfaction of the authority having
 16 jurisdiction.
- 17 I. Structural Elements: Do not cut structural elements without written approval from Engineer.
 18 Notify Engineer of locations and details of cutting and await directions from Engineer before
 19 proceeding. If approved by Engineer:
- 20 1. Shore, brace, and support structural elements during cutting and patching.
 21 2. Do not cut and patch structural elements in a manner that could change their load-
 22 carrying capacity or increase deflection.
- 23 J. Space Requirements: Consider space limitations imposed by contiguous work in selection and
 24 location of equipment and material. Do not provide equipment or material which is not suitable
 25 in this respect.
- 26 K. Tools and Equipment: Select equipment to operate with minimum noise and vibration. If
 27 objectionable noise or vibration is produced or transmitted to or through the building structure by
 28 equipment, piping, ducts or other parts of work, rectify such conditions without cost to the
 29 Owner.
- 30 L. Phasing: Provide all temporary valves, piping, ductwork, equipment, and devices as required.
 31 Maintain temporary services to areas as required. Remove all temporary material and
 32 equipment on completion of work unless Engineer concurs that such material and equipment
 33 would be beneficial to the Owner on a permanent basis.

34 **3.6 OWNER-INSTALLED PRODUCTS**

- 35 A. Coordination: Coordinate construction and operations of the Work with work performed by
 36 Owner's construction personnel.

37 **3.7 PROTECTION OF EXISTING FINISHES, CARPET, AND FURNISHING**

- 38 A. Protect existing finishes, carpet, casework, furnishing, and other building components against
 39 damage and soiling throughout construction activities. Take care during construction not to
 40 damage existing items. Contractor shall be responsible for replacing damaged material or
 41 restoring damaged materials to the Owner's satisfaction.

- 1 B. When permitted by Engineer, items may be removed to a suitable, protected storage location
2 during construction and cleaned and reinstalled in their original locations after construction
3 operations are complete.
- 4 C. Furniture may be relocated during construction and reinstalled in their original locations after
5 construction operations are complete.
- 6 D. Means and methods for protection are the responsibility of the Contractor. Utilize plywood,
7 polyethylene sheeting, dust cloths, and other means as required.

8 **3.8 UTILITY SERVICES AND PLUMBING SYSTEMS**

- 9 A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and
10 protect them against damage.
- 11 B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify,
12 disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas
13 to be selectively demolished.
 - 14 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
 - 15 2. Arrange to shut off utilities with utility companies.
 - 16 3. If services/systems are required to be removed, relocated, or abandoned, provide
17 temporary services/systems that bypass area of selective demolition and that maintain
18 continuity of services/systems to other parts of building.
 - 19 4. Disconnect, demolish, and remove plumbing systems, equipment, and components
20 indicated on Drawings to be removed.
 - 21 a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap
22 or plug remaining piping with same or compatible piping material.
 - 23 b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or
24 compatible piping material and leave in place.
 - 25 c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - 26 d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and
27 remove, clean, and store equipment; when appropriate, reinstall, reconnect, and
28 make equipment operational.
 - 29 e. Equipment to Be Removed and Salvaged: Disconnect and cap services and
30 remove equipment and deliver to Owner.

31 **3.9 CUTTING AND PATCHING**

- 32 A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed
33 with cutting and patching at the earliest feasible time, and complete without delay.
 - 34 1. Cut in-place construction to provide for installation of other components or performance
35 of other construction, and subsequently patch as required to restore surfaces to their
36 original condition.
- 37 B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged
38 during installation or cutting and patching operations, by methods and with materials so as not
39 to void existing warranties.
- 40 C. Temporary Support: Provide temporary support of work to be cut.

- 1 D. Protection: Protect in-place construction during cutting and patching to prevent damage.
 2 Provide protection from adverse weather conditions for portions of Project that might be
 3 exposed during cutting and patching operations.
- 4 E. Structural Elements: When cutting and patching structural elements, notify Engineer of locations
 5 and details of cutting and await directions from Engineer before proceeding. Shore, brace, and
 6 support structural elements during cutting and patching. Do not cut and patch structural
 7 elements in a manner that could change their load-carrying capacity or increase deflection.
- 8 F. Operational Elements: Do not cut and patch operating elements and related components in a
 9 manner that results in reducing their capacity to perform as intended or that results in increased
 10 maintenance or decreased operational life or safety.
- 11 G. Other Construction Elements: Do not cut and patch other construction elements or components
 12 in a manner that could change their load-carrying capacity, that results in reducing their capacity
 13 to perform as intended, or that result in increased maintenance or decreased operational life or
 14 safety.
- 15 H. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence
 16 of cutting and patching. Do not cut and patch exposed construction in a manner that would, in
 17 Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction
 18 that has been cut and patched in a visually unsatisfactory manner.
- 19 I. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar
 20 operations, including excavation, using methods least likely to damage elements retained or
 21 adjoining construction. If possible, review proposed procedures with original Installer; comply
 22 with original Installer's written recommendations.
- 23 1. In general, use hand or small power tools designed for sawing and grinding, not
 24 hammering and chopping. Cut holes and slots neatly to minimum size required, and with
 25 minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 26 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 27 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a
 28 diamond-core drill.
 - 29 4. Excavating and Backfilling: Comply with requirements in applicable Sections where
 30 required by cutting and patching operations.
 - 31 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be
 32 removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent
 33 entrance of moisture or other foreign matter after cutting.
 - 34 6. Proceed with patching after construction operations requiring cutting are complete.
- 35 J. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations
 36 following performance of other work. Patch with durable seams that are as invisible as
 37 practicable. Provide materials and comply with installation requirements specified in other
 38 Sections, where applicable or with in-place materials.
- 39 1. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the
 40 fullest extent possible.
 - 41 2. If identical materials are unavailable or cannot be used, use materials that, when
 42 installed, will provide a match acceptable to Engineer for the visual and functional
 43 performance of in-place materials.
- 44 K. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint,
 45 mortar, oils, putty, and similar materials from adjacent finished surfaces.

1 **3.10 PAINTING**

- 2 A. Comply with requirements with General and Supplementary Conditions, Division 01, Division
3 09, and individual Specification Sections.
- 4 B. Touch-up factory finishes on equipment provided under Division 22. Obtain matched color
5 coatings from the manufacturer and apply as directed. If corrosion is found during inspection on
6 the surface of any equipment, clean, prime, and paint, as required.
- 7 C. Paint the following work where exposed to view:
- 8 1. Uninsulated Metal Piping (bare copper piping not required to be painted unless noted
9 otherwise):
- 10 a. Natural or LP Gas: Yellow
11 b. Other: To be determined by Engineer
- 12 2. Uninsulated plastic piping
13 3. Tanks that do not have factory-applied final finishes.
14 4. Equipment and pipe insulation having a cotton or canvas insulation covering or other
15 paintable jacket material, as outlined in individual Specification Sections.
- 16 D. Paint the following work where exposed in occupied spaces:
- 17 1. Equipment and pipe insulation having a cotton or canvas insulation covering or other
18 paintable jacket material, as outlined in individual Specification Sections.
19 2. Other items as directed by Engineer.
- 20 E. Paint the following work where concealed from and/or exposed to view:
- 21 1. Reuse or Reclaimed Water Supply: Purple

22 **3.11 REPAIR OF WORK**

- 23 A. Complete repair and restoration operations before requesting inspection for determination of
24 Substantial Completion.
- 25 B. Repair or remove and replace defective construction. Repairing includes replacing defective
26 parts, refinishing damaged surfaces, touching up with matching materials, and properly
27 adjusting operating equipment. Where damaged or worn items cannot be repaired or restored,
28 provide replacements. Remove and replace operating components that cannot be repaired.
29 Restore damaged construction and permanent facilities used during construction to specified
30 condition.
- 31 1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces.
32 Replace finishes and surfaces that already show evidence of repair or restoration.
- 33 a. Do not paint over "UL" and other required labels and identification, including
34 mechanical and electrical nameplates. Remove paint applied to required labels
35 and identification.
- 36 2. Replace parts subject to operating conditions during construction that may impede
37 operation or reduce longevity.

1 **3.12 FIELD QUALITY CONTROL**

- 2 A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and
3 inspect components, assemblies, and equipment installations, including connections.
- 4 B. Furnish a letter from the control manufacturer stating that all controls have been checked for
5 operation and calibration, and the system is operating as designed.
- 6 C. Furnish a letter from an authorized factory representative of the air conditioning unit
7 manufacturer stating that the complete refrigeration installation including pipe sizing and routing
8 and operating and safety controls has been checked and is operating properly.
- 9 D. Tests
 - 10 1. Include all tests specified and/or required under laws, rules and regulations of all
11 departments having jurisdiction. Tests shall also be performed as indicated herein and
12 other sections of the specifications.
 - 13 2. After all systems have been completed and put into operation, subject each system to an
14 operating test under design conditions to ensure proper sequence and operation
15 throughout the range of operation. Make adjustments as required to ensure proper
16 functioning of all systems.
 - 17 3. All parts of the work and associated equipment shall be tested and adjusted to work
18 properly and be left in perfect operating condition.
 - 19 4. Correct defects disclosed by these tests without any additional cost to the Owner.
20 Repeat tests on repaired or replaced work.
 - 21 5. Maintain a log of all tests being conducted and have it available for review by the
22 Engineer. Log to indicate date, type of tests, duration, and defects noted and when
23 corrected.
 - 24 6. Special tests on individual systems are specified under individual Specification Sections.
- 25 E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's
26 responsibility, provide quality-control services, including retesting and reinspecting, for
27 construction that replaced Work that failed to comply with the Contract Documents.

28 **3.13 CLEANING**

- 29 A. Progress Cleaning: Clean Project site and work areas daily, including common areas. Enforce
30 requirements strictly. Dispose of materials lawfully.
 - 31 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and
32 debris.
 - 33 2. Do not hold waste materials more than seven days during normal weather or three days if
34 the temperature is expected to rise above 80 deg F (27 deg C).
 - 35 3. Containerize hazardous and unsanitary waste materials separately from other waste.
36 Mark containers appropriately and dispose of legally, according to regulations.
- 37 B. Final Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean
38 each surface or unit to condition expected in an average commercial building cleaning and
39 maintenance program. Comply with manufacturer's written instructions.
 - 40 1. Complete the following cleaning operations before requesting inspection for certification
41 of Substantial Completion for entire Project or for a designated portion of Project:

- 1 a. Remove tools, construction equipment, machinery, and surplus material from
- 2 Project site.
- 3 b. Remove labels that are not permanent.
- 4 c. Wipe surfaces of equipment. Remove excess lubrication, paint and mortar
- 5 droppings, and other foreign substances.

6 **3.14 MAINTENANCE SERVICE**

- 7 A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include
- 8 12 months' full maintenance by skilled employees of systems and equipment Installer. Include
- 9 quarterly preventive maintenance, repair or replacement of worn or defective components,
- 10 lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be
- 11 manufacture's authorized replacement parts and supplies.

12 **END OF SECTION 22 01 00**

1 **SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section includes general requirements for single-phase and polyphase, general-purpose,
8 horizontal, small and medium, squirrel-cage induction motors for use on alternating-current
9 power systems up to 600 V and installed at equipment manufacturer's factory or shipped
10 separately by equipment manufacturer for field installation.

11 **1.3 COORDINATION**

- 12 A. Coordinate features of motors, installed units, and accessory devices to be compatible with the
13 following:
- 14 1. Motor controllers.
 - 15 2. Torque, speed, and horsepower requirements of the load.
 - 16 3. Ratings and characteristics of supply circuit and required control sequence.
 - 17 4. Ambient and environmental conditions of installation location.

18 **PART 2 - PRODUCTS**

19 **2.1 GENERAL MOTOR REQUIREMENTS**

- 20 A. Comply with NEMA MG 1 unless otherwise indicated.
- 21 B. Comply with IEEE 841 for severe-duty motors.

22 **2.2 MOTOR CHARACTERISTICS**

- 23 A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m)
24 above sea level.
- 25 B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected
26 loads at designated speeds, at installed altitude and environment, with indicated operating
27 sequence, and without exceeding nameplate ratings or considering service factor.

28 **2.3 POLYPHASE MOTORS**

- 29 A. Description: NEMA MG 1, Design B, medium induction motor.

- 1 B. Efficiency: Premium efficient, as defined in NEMA MG 1.
- 2 C. Service Factor: 1.15.
- 3 D. Power Factor: 0.80.
- 4 E. Multispeed Motors: Variable torque.
 - 5 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 6 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- 7 F. Multispeed Motors: Separate winding for each speed.
- 8 G. Rotor: Random-wound, squirrel cage.
- 9 H. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- 10 I. Temperature Rise: Match insulation rating.
- 11 J. Insulation: Class F.
- 12 K. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- 13 L. Code Letter Designation:
 - 14 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 15 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- 16 M. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame

17 sizes smaller than 324T.

18 **2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS**

- 19 A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection

20 requirements for controller with required motor leads. Provide terminals in motor terminal box,

21 suited to control method.
- 22 B. Motors Used with Variable-Frequency Controllers:
 - 23 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and

24 tested to resist transient spikes, high frequencies, and short time rise pulses produced by

25 pulse-width-modulated inverters.

26 **2.5 SINGLE-PHASE MOTORS**

- 27 A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements

28 of specific motor application:
 - 29 1. Permanent-split capacitor.
- 30 B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

- 1 C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and
2 thrust loading.
- 3 D. Motors 1/20 HP and Smaller: Shaded-pole type.
- 4 E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when
5 winding temperature exceeds a safe value calibrated to temperature rating of motor insulation.
6 Thermal-protection device shall automatically reset when motor temperature returns to normal
7 range.

8 **PART 3 - EXECUTION (Not Applicable)**

9 **END OF SECTION 22 05 13**

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1 **SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
8 1. Flexible-hose packless expansion joints.

9 **1.3 ACTION SUBMITTALS**

- 10 A. Product Data: For each type of product.

11 **PART 2 - PRODUCTS**

12 **2.1 PERFORMANCE REQUIREMENTS**

- 13 A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures,
14 and temperatures.

15 **2.2 PACKLESS EXPANSION JOINTS**

- 16 A. Flexible-Hose Packless Expansion Joints:
- 17 1. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex
18 Company (The); BBS-NSF (3-inch and smaller), MLP (4-inch and larger) or a comparable
19 product by one of the following:
- 20 a. Flex-Hose Co., Inc.
21 b. Flexicraft Industries.
- 22 2. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
23 3. Expansion Joints for Copper Tubing NPS 3 (DN 75) and Smaller: Copper-alloy fittings
24 with solder-joint end connections.
- 25 a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F (3100
26 kPa at 21 deg C) and 340 psig at 450 deg F (2340 kPa at 232 deg C) ratings.
- 27 4. Expansion Joints for Steel Piping NPS 4 to NPS 6 (DN 100 to DN 150): Carbon-steel
28 fittings with flanged end connections.

- 1 a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70
- 2 deg F (1380 kPa at 21 deg C) and 145 psig at 600 deg F (1000 kPa at 315 deg C)
- 3 ratings.

- 4 5. Expansion Joints for Steel Piping NPS 8 to NPS 12 (DN 200 to DN 300): Carbon-steel
- 5 fittings with flanged end connections.
- 6 a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70
- 7 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C)
- 8 ratings.

- 9 6. Expansion Joints for Steel Piping NPS 14 (DN 350) and Larger: Carbon-steel fittings with
- 10 flanged end connections.

- 11 a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70
- 12 deg F (1130 kPa at 21 deg C) and 120 psig at 600 deg F (830 kPa at 315 deg C)
- 13 ratings.

14 **PART 3 - EXECUTION**

15 **3.1 EXPANSION JOINT INSTALLATION**

- 16 A. Install expansion joints of sizes matching sizes of piping in which they are installed.

17 **END OF SECTION 22 05 16**

1 **SECTION 22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Sleeves.
9 2. Stack-sleeve fittings.
10 3. Sleeve-seal systems.
11 4. Sleeve-seal fittings.
12 5. Grout.
13 6. Silicone sealants.

14 **1.3 ACTION SUBMITTALS**

- 15 A. Product Data: For each type of product.

16 **1.4 INFORMATIONAL SUBMITTALS**

- 17 A. Field quality-control reports.

18 **PART 2 - PRODUCTS**

19 **2.1 SLEEVES**

- 20 A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, with plain
21 ends.
22 B. Galvanized-Steel Sheet Sleeves: 0.0239-inch (0.6-mm) minimum thickness; round tube closed
23 with welded longitudinal joint.

24 **2.2 STACK-SLEEVE FITTINGS**

- 25 A. Description: Manufactured, cast-iron sleeve with integral clamping flange for use in waterproof
26 floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
27 1. Underdeck Clamp: Clamping ring with setscrews.

1 **2.3 SLEEVE-SEAL SYSTEMS**

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

- 4 1. Advance Products & Systems, Inc.
- 5 2. Metraflex Company (The).
- 6 3. Pipeline Seal and Insulator, Inc.

7 B. Description:

- 8 1. Modular sealing-element unit, designed for field assembly, for filling annular space
 9 between piping and sleeve.
- 10 2. Designed to form a hydrostatic seal of 20 psig (137 kPa) minimum.
- 11 3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include
 12 type and number required for pipe material and size of pipe.
- 13 4. Pressure Plates: Composite plastic.
- 14 5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates
 15 to sealing elements.

16 **2.4 SLEEVE-SEAL FITTINGS**

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

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

20 **2.5 GROUT**

21 A. Description: Non-shrinking, for interior and exterior sealing openings in non-fire-rated walls or
 22 floors.

23 B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry,
 24 hydraulic-cement grout.

25 C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

26 D. Packaging: Premixed and factory packaged.

27 **2.6 SILICONE SEALANTS**

28 A. Silicone, S, NS, 25, NT: Single-component, non-sag, plus 25 percent and minus 25 percent
 29 movement capability, non-traffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S,
 30 Grade NS, Class 25, Use NT.

- 31 1. Sealant shall have a VOC content of 250 g/L or less.

32 B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent
 33 movement capability, traffic- and non-traffic-use, neutral-curing silicone joint sealant;
 34 ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling)
 35 formulation is for opening in floors and other horizontal surfaces that are not fire rated.

- 36 1. Sealant shall have a VOC content of 250 g/L or less.

- 1 C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and
 2 cure in place to produce a flexible, non-shrinking foam.
 3 1. Sealant shall have a VOC content of 250 g/L or less.

4 **PART 3 - EXECUTION**

5 **3.1 SLEEVE INSTALLATION**

6 A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

7 B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to
 8 provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls.

9 1. Sleeves are not required for core-drilled holes.

10 C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and
 11 walls are constructed.

12 1. Cut sleeves to length for mounting flush with both surfaces.

13 a. Exception: Extend sleeves installed in floors of mechanical equipment areas or
 14 other wet areas 2 inches (50 mm) above finished floor level.

15 2. Using grout or silicone sealant, seal the space outside of sleeves in slabs and walls
 16 without sleeve-seal system.

17 D. Install sleeves for pipes passing through interior partitions.

18 1. Cut sleeves to length for mounting flush with both surfaces.

19 2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space
 20 between sleeve and pipe or pipe insulation.

21 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants
 22 appropriate for size, depth, and location of joint.

23 E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier
 24 Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at
 25 pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with
 26 requirements for Firestopping and fill materials specified in Section 07 84 13 "Penetration
 27 Firestopping."

28 **3.2 STACK-SLEEVE-FITTING INSTALLATION**

29 A. Install stack-sleeve fittings in new slabs as slabs are constructed.

30 1. Install fittings that are large enough to provide 1/4-inch (6.4-mm) annular clear space
 31 between sleeve and pipe or pipe insulation.

32 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane
 33 waterproofing. Comply with requirements for flashing specified in Section 07 62 00
 34 "Sheet Metal Flashing and Trim."

35 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished
 36 floor level.

37 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring
 38 is specified.

- 1 5. Use silicone sealant to seal the space around outside of stack-sleeve fittings.
- 2 B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier
- 3 Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe
- 4 penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping
- 5 specified in Section 07 84 13 "Penetration Firestopping."

6 **3.3 SLEEVE-SEAL-SYSTEM INSTALLATION**

- 7 A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service
- 8 piping entries into building.
- 9 B. Select type, size, and number of sealing elements required for piping material and size and for
- 10 sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration,
- 11 assemble sleeve-seal system components, and install in annular space between piping and
- 12 sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make
- 13 a watertight seal.

14 **3.4 SLEEVE-SEAL-FITTING INSTALLATION**

- 15 A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- 16 B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and
- 17 walls. Position waterstop flange to be centered in concrete slab or wall.
- 18 C. Secure nailing flanges to concrete forms.
- 19 D. Use grout or silicone sealant to seal the space around outside of sleeve-seal fittings.

20 **3.5 FIELD QUALITY CONTROL**

- 21 A. Perform the following tests and inspections:
- 22 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair
- 23 leaks and retest until no leaks exist.
- 24 B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- 25 C. Prepare test and inspection reports.

26 **3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- 27 A. Use sleeves and sleeve seals for the following piping-penetration applications:
- 28 1. Exterior Concrete Walls above Grade:
- 29 a. Piping Smaller than NPS 6 (DN 150): Steel pipe sleeves.
- 30 b. Piping NPS 6 (DN 150) and Larger: Steel pipe sleeves.
- 31 2. Exterior Concrete Walls below Grade:

- 1 a. Piping Smaller than NPS 4 (DN 100): Sleeve-seal fittings.
- 2 b. Piping NPS 4 (DN 100) and Larger: Steel pipe sleeves with sleeve-seal system.
- 3 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between
- 4 piping and sleeve for installing sleeve-seal system.
- 5 3. Concrete Slabs-on-Grade:
- 6 a. Piping Smaller than NPS 4 (DN 100): Sleeve-seal fittings.
- 7 b. Piping NPS 4 (DN 100) and Larger: Steel pipe sleeves with sleeve-seal system.
- 8 1) Select sleeve size to allow for 1-inch (25-mm) annular clear space between
- 9 piping and sleeve for installing sleeve-seal system.
- 10 4. Concrete Slabs above Grade:
- 11 a. Piping Smaller Than NPS 6 (DN 150): Steel pipe sleeves.
- 12 b. Piping NPS 6 (DN 150) and Larger: Steel pipe sleeves.
- 13 5. Interior Partitions:
- 14 a. Piping Smaller Than NPS 6 (DN 150): Steel pipe sleeves.
- 15 b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel sheet sleeves.
- 16 6. Concrete Slabs with Water Proof Membrane and Roof Decks: Stack-sleeve fittings.
- 17 **END OF SECTION 22 05 17**

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1 **SECTION 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Escutcheons.
9 2. Floor plates.

10 **1.3 DEFINITIONS**

- 11 A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise
12 indicated to be removed and salvaged, or removed and reinstalled.

13 **1.4 ACTION SUBMITTALS**

- 14 A. Product Data: For each type of product.

15 **PART 2 - PRODUCTS**

16 **2.1 ESCUTCHEONS**

- 17 A. One-Piece, Cast-Brass Type: With polished, chrome-plated and polished brass finish and
18 setscrew fastener.

- 19 B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated
20 finish and spring-clip fasteners.

- 21 C. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

22 **2.2 FLOOR PLATES**

- 23 A. One-Piece Floor Plates: Cast-iron flange

1 **PART 3 - EXECUTION**

2 **3.1 INSTALLATION**

- 3 A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- 4 B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and
5 with OD that completely covers opening.
- 6 1. Escutcheons for New Piping:
- 7 a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
- 8 b. Chrome-Plated Piping: One-piece cast brass with polished, chrome-plated finish.
- 9 c. Insulated Piping: One-piece stamped steel with polished, chrome-plated finish.
- 10 d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast
11 brass with polished, chrome-plated finish.
- 12 e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with
13 polished, chrome-plated finish.
- 14 f. Bare Piping in Unfinished Service Spaces: One-piece cast brass with rough-brass
15 finish.
- 16 g. Bare Piping in Equipment Rooms: One-piece cast brass with rough-brass finish.
- 17 C. Install floor plates for piping penetrations of equipment-room floors.
- 18 D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD
19 that completely covers opening.
- 20 1. New Piping: One-piece, floor plate.
- 21 2. Existing Piping: Split floor plate.

22 **3.2 FIELD QUALITY CONTROL**

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

24 **END OF SECTION 22 05 18**

1 **SECTION 22 05 19 - METERS AND GAGES FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
- 8 1. Liquid-in-glass thermometers.
 - 9 2. Thermowells.
 - 10 3. Dial-type pressure gages.
 - 11 4. Gage attachments.
 - 12 5. Test plugs.
- 13 B. Related Requirements:
- 14 1. Section 22 11 13 "Facility Water Distribution Piping" for domestic water meters and
15 combined domestic and fire-protection water-service meters outside the building.
 - 16 2. Section 22 11 19 "Domestic Water Piping Specialties" for water meters inside the
17 building.
 - 18 3. Section 22 15 13 "General-Service Compressed-Air Piping" for compressed air gages.

19 **1.3 ACTION SUBMITTALS**

- 20 A. Product Data: For each type of product.

21 **1.4 INFORMATIONAL SUBMITTALS**

- 22 A. Product Certificates: For each type of meter and gage.

23 **1.5 CLOSEOUT SUBMITTALS**

- 24 A. Operation and Maintenance Data: For meters and gages to include in operation and
25 maintenance manuals.

26 **PART 2 - PRODUCTS**

27 **2.1 LIQUID-IN-GLASS THERMOMETERS**

- 28 A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

- 1 1. Basis-of-Design Product: Subject to compliance with requirements, provide Terrice H.O.
- 2 Co.; BX9 or comparable product by one of the following:
- 3 a. Weiss Instruments, Inc.
- 4 b. Winters Instruments - U.S.
- 5 2. Standard: ASME B40.200.
- 6 3. Case: Cast aluminum; 9-inch (229-mm) nominal size unless otherwise indicated.
- 7 4. Case Form: Adjustable angle unless otherwise indicated.
- 8 5. Tube: Glass with magnifying lens and blue or red organic liquid.
- 9 6. Tube Background: Non-reflective aluminum with permanently etched scale markings
- 10 graduated in deg F (deg C).
- 11 7. Window: Glass.
- 12 8. Stem: Aluminum and of length to suit installation.
- 13 a. Design for Thermowell Installation: Bare stem.
- 14 9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
- 15 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of
- 16 1.5 percent of scale range.

17 2.2 THERMOWELLS

- 18 A. Thermowells:
 - 19 1. Standard: ASME B40.200.
 - 20 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 21 3. Material for Use with Copper Tubing: CNR (copper nicket 90-10).
 - 22 4. Material for Use with Steel Piping: CRES (stainless steel).
 - 23 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 24 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1 (DN 15, DN 20, or NPS 25),
 - 25 ASME B1.20.1 pipe threads.
 - 26 7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw
 - 27 threads.
 - 28 8. Bore: Diameter required to match thermometer bulb or stem.
 - 29 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 30 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 31 11. Bushings: For converting size of thermowell's internal screw thread to size of
 - 32 thermometer connection.
- 33 B. Heat-Transfer Medium: Mixture of graphite and glycerin.

34 2.3 PRESSURE GAGES

- 35 A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
 - 36 1. Basis-of-Design Product: Subject to compliance with requirements, provide Terrice H.O.
 - 37 Co.; 600CB or comparable product by one of the following:
 - 38 a. Ashcroft Inc.
 - 39 b. Miljoco Corporation.
 - 40 c. Weiss Instruments, Inc.
 - 41 d. Winters Instruments - U.S.

- 1 2. Standard: ASME B40.100.
- 2 3. Case: Solid-front, pressure relief type(s); cast aluminum; 4-1/2-inch (114-mm) nominal
- 3 diameter.
- 4 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- 5 5. Pressure Connection: Brass, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and
- 6 bottom-outlet type unless back-outlet type is indicated.
- 7 6. Movement: Mechanical, with link to pressure element and connection to pointer.
- 8 7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi
- 9 (kPa).
- 10 8. Pointer: Dark-colored metal.
- 11 9. Window: Glass.
- 12 10. Ring: Stainless steel.
- 13 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

14 **2.4 GAGE ATTACHMENTS**

- 15 A. Snubbers: ASME B40.100, brass; with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads and
- 16 porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- 17 B. Valves: Brass ball, with NPS 1/4 (DN 8), ASME B1.20.1 pipe threads.

18 **2.5 TEST PLUGS**

- 19 A. Basis-of-Design Product: Subject to compliance with requirements, provide Peterson
- 20 Equipment Co., Inc.; Model 110 XL or comparable product by one of the following:
 - 21 1. Sisco Manufacturing Company, Inc.
 - 22 2. Trerice, H. O. Co.
 - 23 3. Weiss Instruments, Inc.
- 24 B. Description: Test-station fitting made for insertion into piping tee fitting.
- 25 C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include
- 26 extended stem on units to be installed in insulated piping.
- 27 D. Thread Size: NPS 1/4 (DN 8), ASME B1.20.1 pipe thread.
- 28 E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- 29 F. Core Inserts: EPDM self-sealing rubber.

30 **PART 3 - EXECUTION**

31 **3.1 INSTALLATION**

- 32 A. Install thermowells with socket extending a minimum of 2 inches (51 mm) into fluid and in
- 33 vertical position in piping tees.
- 34 B. Install thermowells of sizes required to match thermometer connectors. Include bushings if
- 35 required to match sizes.

- 1 C. Install thermowells with extension on insulated piping.
- 2 D. Fill thermowells with heat-transfer medium.
- 3 E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- 4 F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the
- 5 most readable position.
- 6 G. Install valve and snubber in piping for each pressure gage for fluids.
- 7 H. Install test plugs in piping tees.
- 8 I. Install thermometers in the following locations:
 - 9 1. Inlet and outlet of each water heater.
 - 10 2. Inlets and outlets of each domestic water heat exchanger.
 - 11 3. Inlet and outlet of each domestic hot-water storage tank.
- 12 J. Install pressure gages in the following locations:
 - 13 1. Building water service entrance into building.
 - 14 2. Inlet and outlet of each pressure-reducing valve.
 - 15 3. Suction and discharge of each domestic water pump.
- 16 **3.2 CONNECTIONS**
- 17 A. Install meters and gages adjacent to machines and equipment to allow service and
- 18 maintenance of meters, gages, machines, and equipment.
- 19 **3.3 ADJUSTING**
- 20 A. Adjust faces of meters and gages to proper angle for best visibility.
- 21 **3.4 THERMOMETER SCHEDULE**
- 22 A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 23 1. Metal case, industrial-style, liquid-in-glass type.
- 24 B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be the
- 25 following:
 - 26 1. Metal case, industrial-style, liquid-in-glass type.
 - 27 2. Test plug with EPDM self-sealing rubber inserts.
- 28 C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be the following:
 - 29 1. Metal case, industrial-style, liquid-in-glass type.
- 30 D. Thermometer stems shall be of length to match thermowell insertion length.

1 **3.5 THERMOMETER SCALE-RANGE SCHEDULE**

2 A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F (Minus 20 to plus 70 deg C).

3 B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F (0 to 150 deg C).

4 **3.6 PRESSURE-GAGE SCHEDULE**

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

6 1. Solid-front, pressure-relief, direct-mounted, metal case.

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

8 1. Solid-front, pressure-relief, direct-mounted, metal case.

9 2. Test plug with EPDM self-sealing rubber inserts.

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

11 1. Solid-front, pressure-relief, direct-mounted, metal case.

12 2. Test plug with EPDM self-sealing rubber inserts.

13 **3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE**

14 A. Scale Range for Domestic Water Piping: 0 to 160 psi (0 to 1100 kPa).

15 **END OF SECTION 22 05 19**

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1 **SECTION 22 05 23.14 - CHECK VALVES FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Bronze swing check valves.
9 2. Iron swing check valves.
10 3. Iron, center-guided check valves.

11 **1.3 DEFINITIONS**

- 12 A. CWP: Cold working pressure.
13 B. EPDM: Ethylene propylene-diene terpolymer rubber.

14 **1.4 ACTION SUBMITTALS**

- 15 A. Product Data: For each type of valve.
16 1. Certification that products comply with NSF 61.

17 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 18 A. Prepare valves for shipping as follows:

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

- 22 B. Use the following precautions during storage:

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

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

1 **PART 2 - PRODUCTS**

2 **2.1 GENERAL REQUIREMENTS FOR VALVES**

- 3 A. Source Limitations for Valves: Obtain each type of valve from single source from single
4 manufacturer.
- 5 B. ASME Compliance:
 - 6 1. ASME B1.20.1 for threads for threaded end valves.
 - 7 2. ASME B16.1 for flanges on iron valves.
 - 8 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 9 4. ASME B31.9 for building services piping valves.
- 10 C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- 11 D. Drinking Water System Components - Health Effects and Drinking Water System Components -
12 Lead Content Compliance: NSF 61.
- 13 E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with
14 copper alloy (brass) containing more than 15 percent zinc are not permitted.
- 15 F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system
16 pressures and temperatures.
- 17 G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- 18 H. Valve Bypass and Drain Connections: MSS SP-45.

19 **2.2 BRONZE SWING CHECK VALVES**

- 20 A. Bronze Swing Check Valves with Nonmetallic Disc, Class 150:
 - 21 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
22 following:
 - 23 a. [Crane Co.; Crane Valve Group; Crane Valves.](#)
 - 24 b. [Milwaukee Valve Company.](#)
 - 25 c. [Watts Regulator Co.; a division of Watts Water Technologies, Inc.](#)
 - 26 2. Description:
 - 27 a. Standard: MSS SP-80, Type 4.
 - 28 b. CWP Rating: 300 psig (2070 kPa).
 - 29 c. Body Design: Horizontal flow.
 - 30 d. Body Material: ASTM B 62, bronze.
 - 31 e. Ends: Threaded or soldered. See valve schedule articles.
 - 32 f. Disc: PTFE.

33 **2.3 IRON SWING CHECK VALVES**

- 34 A. Iron Swing Check Valves with Metal Seats, Class 125:

- 1 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
 2 following:
- 3 a. Crane Co.; Crane Valve Group; Crane Valves.
 4 b. Milwaukee Valve Company.
 5 c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 6 2. Description:
- 7 a. Standard: MSS SP-71, Type I.
 8 b. CWP Rating: 200 psig (1380 kPa).
 9 c. Body Design: Clear or full waterway.
 10 d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 11 e. Ends: Flanged or threaded. See valve schedule articles.
 12 f. Trim: Bronze.
 13 g. Gasket: Asbestos free.
- 14 B. Iron Swing Check Valves with Metal Seats, Class 250:
- 15 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
 16 following:
- 17 a. Crane Co.; Crane Valve Group; Crane Valves.
 18 b. Milwaukee Valve Company.
 19 c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 20 2. Description:
- 21 a. Standard: MSS SP-71, Type I.
 22 b. CWP Rating: 500 psig (3450 kPa).
 23 c. Body Design: Clear or full waterway.
 24 d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 25 e. Ends: Flanged or threaded. See valve schedule articles.
 26 f. Trim: Bronze.
 27 g. Gasket: Asbestos free.

28 **2.4 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES**

- 29 A. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 125:
- 30 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
 31 following:
- 32 a. Milwaukee Valve Company.
 33 b. Mueller Steam Specialty; a division of SPX Corporation.
 34 c. Watts Regulator Co.; A division of Watts Water Technologies, Inc.
- 35 2. Description:
- 36 a. Standard: MSS SP-125.
 37 b. CWP Rating: 200 psig (1380 kPa).
 38 c. Body Material: ASTM A 126, gray iron.
 39 d. Style: Globe, spring loaded.
 40 e. Ends: Flanged.
 41 f. Seat: Bronze.

- 1 B. Iron Globe, Center-Guided Check Valves with Metal Seat, Class 250:
- 2 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
- 3 following:
- 4 a. Milwaukee Valve Company.
- 5 b. Mueller Steam Specialty; a division of SPX Corporation.
- 6 c. NIBCO INC.
- 7 2. Description:
- 8 a. Standard: MSS SP-125.
- 9 b. CWP Rating: 400 psig (2760 kPa).
- 10 c. Body Material: ASTM A 126, gray iron.
- 11 d. Style: Globe, spring loaded.
- 12 e. Ends: Flanged.
- 13 f. Seat: Bronze.

14 PART 3 - EXECUTION

15 3.1 EXAMINATION

- 16 A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove
- 17 special packing materials, such as blocks, used to prevent disc movement during shipping and
- 18 handling.
- 19 B. Operate valves in positions from fully open to fully closed. Examine guides and seats made
- 20 accessible by such operations.
- 21 C. Examine threads on valve and mating pipe for form and cleanliness.
- 22 D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper
- 23 size, length, and material. Verify that gasket is of proper size, that its material composition is
- 24 suitable for service, and that it is free from defects and damage.
- 25 E. Do not attempt to repair defective valves; replace with new valves.

26 3.2 VALVE INSTALLATION

- 27 A. Install valves with unions or flanges at each piece of equipment arranged to allow service,
- 28 maintenance, and equipment removal without system shutdown.
- 29 B. Locate valves for easy access and provide separate support where necessary.
- 30 C. Install valves in horizontal piping with stem at or above center of pipe.
- 31 D. Install valves in position to allow full stem movement.
- 32 E. Check Valves: Install check valves for proper direction of flow.
- 33 1. Swing Check Valves: In horizontal position with hinge pin level.
- 34 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

- 1 F. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing
2 Piping and Equipment" for valve tags and schedules.

3 **3.3 ADJUSTING**

- 4 A. Adjust or replace valve packing after piping systems have been tested and put into service but
5 before final adjusting and balancing. Replace valves if persistent leaking occurs.

6 **3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- 7 A. If valve applications are not indicated, use the following:

- 8 1. Pump-Discharge Check Valves:

- 9 a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with nonmetallic disc.
10 b. NPS 2-1/2 (DN 65) and Larger for Domestic Water: Iron , center-guided, metal-
11 seat check valves.
12 c. NPS 2-1/2 (DN 65) and Larger for Sanitary Waste and Storm Drainage: Iron swing
13 check valves with lever and weight or spring.

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

- 16 C. End Connections:

- 17 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded or soldered or press-ends.
18 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
19 3. For Copper Tubing, NPS 5 (DN 125) and Larger: Flanged.
20 4. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded.
21 5. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
22 6. For Steel Piping, NPS 5 (DN 125) and Larger: Flanged.

23 **3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)**

- 24 A. Pipe NPS 2 (DN 50) and Smaller:

- 25 1. Horizontal and Vertical Applications: Bronze swing check valves with nonmetallic disc,
26 Class 150, with threaded end connections.

- 27 B. Pipe NPS 2-1/2 (DN 65) and Larger:

- 28 1. Iron swing check valves with metalseats, Class 250, with flanged end connections.

29 **3.6 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO
30 1380 kPa)**

- 31 A. Pipe NPS 2 (DN 50) and Smaller:

- 32 1. Horizontal and Vertical Applications: Bronze swing check valves with nonmetallic disc,
33 Class 150, with threaded end connections.

- 1 B. Pipe NPS 2-1/2 (DN 65) and Larger:
- 2 1. Iron swing check valves with metal seats, Class 250, with flanged end connections.

3 **3.7 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- 4 A. Pipe NPS 2 (DN 50) and Smaller:
 - 5 1. Bronze swing check valves with nonmetallic disc, Class 150, with threaded end
 - 6 connections.
 - 7 2. Bronze swing check valves with press-end connections.
- 8 B. Pipe NPS 2-1/2 (DN 65) and Larger:
 - 9 1. Iron swing check valves with metal seats, Class 125, with flanged end connections.

10 **END OF SECTION 22 05 23.14**

1 **SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
8 1. Bronze ball valves.
9 2. Stainless steel ball valves.

10 **1.3 DEFINITIONS**

- 11 A. CWP: Cold working pressure.

12 **1.4 ACTION SUBMITTALS**

- 13 A. Product Data: For each type of valve.
14 1. Certification that products comply with NSF 61.

15 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 16 A. Prepare valves for shipping as follows:
17 1. Protect internal parts against rust and corrosion.
18 2. Protect threads, flange faces, and soldered ends.
19 3. Set ball valves open to minimize exposure of functional surfaces.
- 20 B. Use the following precautions during storage:
21 1. Maintain valve end protection.
22 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If
23 outdoor storage is necessary, store valves off the ground in watertight enclosures.
- 24 C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use
25 operating handles or stems as lifting or rigging points.

1 **PART 2 - PRODUCTS**

2 **2.1 GENERAL REQUIREMENTS FOR VALVES**

- 3 A. Source Limitations for Valves: Obtain each type of valve from single source from single
4 manufacturer.
- 5 B. ASME Compliance:
- 6 1. ASME B1.20.1 for threads for threaded end valves.
7 2. ASME B31.9 for building services piping valves.
- 8 C. NSF Compliance: NSF 61 for valve materials for potable-water service.
- 9 D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with
10 copper alloy (brass) containing more than 15 percent zinc are not permitted.
- 11 E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system
12 pressures and temperatures.
- 13 F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- 14 G. Valve Actuator Types:
- 15 1. Handlever
- 16 H. Valves in Insulated Piping:
- 17 1. Include 2-inch (50-mm) stem extensions.
18 2. Extended operating handles of non-thermal conductive material and protective sleeves
19 that allow operation of valves without breaking vapor seals or disturbing insulation.
20 3. Memory stops that are fully adjustable after insulation is applied.

21 **2.2 BRONZE BALL VALVES**

- 22 A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
- 23 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
24 following:
- 25 a. Conbraco Industries, Inc.; Apollo Valves.
26 b. Crane Co.; Crane Valve Group; Crane Valves.
27 c. Hammond Valve.
28 d. Milwaukee Valve Company.
29 e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 30 2. Description:
- 31
- 32 a. Standard: MSS SP-110 or MSS-145.
33 b. CWP Rating: 600 psig (4140 kPa).
34 c. Body Design: Two piece.
35 d. Body Material: Bronze.

- 1 e. Ends: Threaded or soldered.
- 2 f. Seats: PTFE.
- 3 g. Stem: Stainless steel.
- 4 h. Ball: Stainless steel, vented.
- 5 i. Port: Full.

6 B. Bronze Ball Valves, Two-Piece, Safety-Exhaust:

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

- 9 a. Conbraco Industries, Inc.; Apollo Valves.
- 10 b. Crane Co.; Crane Valve Group; Crane Valves.
- 11 c. Hammond Valve.
- 12 d. Milwaukee Valve Company.
- 13 e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

- 14 2. Description:

- 16 a. Standard: MSS SP-110.
- 17 b. CWP Rating: 600 psig (4140 kPa).
- 18 c. Body Design: Two piece.
- 19 d. Body Material: Bronze, ASTM B 584, Alloy C844.
- 20 e. Ends: Threaded.
- 21 f. Seats: PTFE.
- 22 g. Stem: Stainless steel.
- 23 h. Ball: Chrome-plated brass, with exhaust vent opening for pneumatic applications.
- 24 i. Port: Full.

25 **PART 3 - EXECUTION**

26 **3.1 EXAMINATION**

- 27 A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove
28 special packing materials, such as blocks, used to prevent disc movement during shipping and
29 handling.
- 30 B. Operate valves in positions from fully open to fully closed. Examine guides and seats made
31 accessible by such operations.
- 32 C. Examine threads on valve and mating pipe for form and cleanliness.
- 33 D. Do not attempt to repair defective valves; replace with new valves.

34 **3.2 VALVE INSTALLATION**

- 35 A. Install valves with unions or flanges at each piece of equipment arranged to allow service,
36 maintenance, and equipment removal without system shutdown.
- 37 B. Locate valves for easy access and provide separate support where necessary.

- 1 C. Install valves in horizontal piping with stem at or above center of pipe.
- 2 D. Install valves in position to allow full stem movement.
- 3 E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing
- 4 Piping and Equipment" for valve tags and schedules.

5 **3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS**

- 6 A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP
- 7 ratings may be substituted.
- 8 B. Select valves with the following end connections:
 - 9 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-
 - 10 joint valve-end option or press-end option is indicated in valve schedules below.
 - 11 2. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded ends.

12 **3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)**

- 13 A. Pipe NPS 2 (DN 50) and Smaller:
 - 14 1. Bronze ball valves, two-piece with full port and stainless steel trim.

15 **3.5 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO**

16 **1380 kPa)**

- 17 A. Pipe NPS 2 (DN 50) and Smaller:
 - 18 1. Bronze ball valves, two-piece with full port and stainless steel trim.

19 **3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

- 20 A. Pipe NPS 2 (DN 50) and Smaller:
 - 21 1. Bronze ball valves, two-piece with full port and stainless steel trim. Provide with threaded
 - 22 or solder-joint ends.

23 **END OF SECTION 22 05 23.12**

1 **SECTION 22 05 23.13 - BUTTERFLY VALVES FOR PLUMBING PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
8 1. Iron, single-flange butterfly valves.

9 **1.3 DEFINITIONS**

- 10 A. CWP: Cold working pressure.
11 B. EPDM: Ethylene propylene-diene terpolymer rubber.

12 **1.4 ACTION SUBMITTALS**

- 13 A. Product Data: For each type of valve.
14 1. Certification that products comply with NSF 61 Annex G.

15 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 16 A. Prepare valves for shipping as follows:
17 1. Protect internal parts against rust and corrosion.
18 2. Protect threads, flange faces, grooves, and weld ends.
19 3. Set butterfly valves closed or slightly open.
20 B. Use the following precautions during storage:
21 1. Maintain valve end protection.
22 2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If
23 outdoor storage is necessary, store valves off the ground in watertight enclosures.
24 C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use
25 handwheels or stems as lifting or rigging points.

1 **PART 2 - PRODUCTS**

2 **2.1 GENERAL REQUIREMENTS FOR VALVES**

- 3 A. Source Limitations for Valves: Obtain each type of valve from single source from single
4 manufacturer.
- 5 B. ASME Compliance:
- 6 1. ASME B16.1 for flanges on iron valves.
7 2. ASME B16.5 for flanges on steel valves.
8 3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
9 4. ASME B31.9 for building service piping valves.
- 10 C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- 11 D. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.
- 12 E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system
13 pressures and temperatures.
- 14 F. Valve Sizes: Same as upstream piping unless otherwise indicated.
- 15 G. Valve Actuator Types:
- 16 1. Gear Actuator: For valves NPS 8 (DN 200) and larger.
17 2. Handlever: For valves NPS 6 (DN 150) and smaller.
- 18 H. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions.

19 **2.2 IRON, SINGLE-FLANGE BUTTERFLY VALVES**

- 20 A. Iron, Single-Flange Butterfly Valves with Aluminum-Bronze Disc:
- 21 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
22 following:
- 23 a. Crane Co.; Crane Valve Group; Jenkins Valves.
24 b. Milwaukee Valve Company.
25 c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 26 2. Description:
- 27 a. Standard: MSS SP-67, Type I.
28 b. CWP Rating: 200 psig (1380 kPa).
29 c. Body Design: Lug type; suitable for bidirectional dead-end service at rated
30 pressure without use of downstream flange.
31 d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
32 e. Seat: EPDM.
33 f. Stem: One- or two-piece stainless steel.
34 g. Disc: Aluminum bronze.

1 **PART 3 - EXECUTION**

2 **3.1 EXAMINATION**

- 3 A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove
4 special packing materials, such as blocks, used to prevent disc movement during shipping and
5 handling.
- 6 B. Operate valves in positions from fully open to fully closed. Examine guides and seats made
7 accessible by such operations.
- 8 C. Examine mating flange faces for damage. Check bolting for proper size, length, and material.
9 Verify that gasket is of proper size, that its material composition is suitable for service, and that
10 it is free from defects and damage.
- 11 D. Do not attempt to repair defective valves; replace with new valves.

12 **3.2 VALVE INSTALLATION**

- 13 A. Install valves with unions or flanges at each piece of equipment arranged to allow service,
14 maintenance, and equipment removal without system shutdown.
- 15 B. Locate valves for easy access and provide separate support where necessary.
- 16 C. Install valves in horizontal piping with stem at or above center of pipe.
- 17 D. Install valves in position to allow full stem movement.
- 18 E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing
19 Piping and Equipment" for valve tags and schedules.

20 **3.3 ADJUSTING**

- 21 A. Adjust or replace valve packing after piping systems have been tested and put into service but
22 before final adjusting and balancing. Replace valves if persistent leaking occurs.

23 **3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)**

- 24 A. Pipe NPS 2-1/2 (DN 65) and Larger:
 - 25 1. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze disc.

26 **3.5 HIGH-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 TO 200 PSIG (1035 TO**
27 **1380 kPa)**

- 28 A. Pipe NPS 2-1/2 (DN 65) and Larger:
 - 29 1. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze disc.

1 **3.6 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE**

2 A. Pipe NPS 2-1/2 (DN 65) and Larger:

3 1. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.

4 **END OF SECTION 22 05 23.13**

1 **SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Metal pipe hangers and supports.
9 2. Trapeze pipe hangers.
10 3. Metal framing systems.
11 4. Fastener systems.
12 5. Pipe stands.
13 6. Pipe-positioning systems.
14 7. Equipment supports.

- 15 B. Related Requirements:

- 16 1. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and
17 anchors.
18 2. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration
19 isolation devices.

20 **1.3 DEFINITIONS**

- 21 A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

22 **1.4 ACTION SUBMITTALS**

- 23 A. Product Data: For each type of product.

- 24 B. Shop Drawings: Show fabrication and installation details and include calculations for the
25 following:

- 26 1. Trapeze pipe hangers.
27 2. Metal framing systems.
28 3. Pipe stands.
29 4. Equipment supports.

1 **PART 2 - PRODUCTS**

2 **2.1 PERFORMANCE REQUIREMENTS**

- 3 A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00
 4 "Quality Requirements," to design trapeze pipe hangers and equipment supports.
- 5 B. Structural Performance: Hangers and supports for plumbing piping and equipment shall
 6 withstand the effects of gravity loads and stresses within limits and under conditions indicated
 7 according to ASCE/SEI 7.
- 8 1. Design supports for multiple pipes, including pipe stands, capable of supporting
 9 combined weight of supported systems, system contents, and test water.
- 10 2. Design equipment supports capable of supporting combined operating weight of
 11 supported equipment and connected systems and components.

12 **2.2 METAL PIPE HANGERS AND SUPPORTS**

- 13 A. Carbon-Steel Pipe Hangers and Supports:
- 14 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 15 2. Galvanized Metallic Coatings: Pre-galvanized, hot-dip galvanized, or electro-galvanized.
 16 3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
 17 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to
 18 support bearing surface of piping.
 19 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- 20 B. Stainless-Steel Pipe Hangers and Supports:
- 21 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 22 2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to
 23 support bearing surface of piping.
 24 3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.
- 25 C. Copper Pipe and Tube Hangers:
- 26 1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated
 27 components.
 28 2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

29 **2.3 TRAPEZE PIPE HANGERS**

- 30 A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from
 31 structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and
 32 U-bolts.

33 **2.4 METAL FRAMING SYSTEMS**

- 34 A. MFMA Manufacturer Metal Framing Systems:

- 1 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
2 following:
- 3 a. Cooper B-Line, Inc.
4 b. Flex-Strut Inc.
5 c. Unistrut Corporation; Tyco International, Ltd.
- 6 2.
7 3. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels,
8 accessories, fittings, and other components for supporting multiple parallel pipes.
9 4. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
10 5. Channels: Continuous slotted carbon-steel channel with inturned lips.
11 6. Channel Width: Selected for applicable load criteria.
12 7. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot
13 and, when tightened, prevent slipping along channel.
14 8. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
15 9. Metallic Coating: Electroplated zinc or Hot-dip galvanized.
- 16 B. Non-MFMA Manufacturer Metal Framing Systems:
- 17 1.
18 2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels,
19 accessories, fittings, and other components for supporting multiple parallel pipes.
20 3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
21 4. Channels: Continuous slotted carbon-steel channel with inturned lips.
22 5. Channel Width: Select for applicable load criteria.
23 6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot
24 and, when tightened, prevent slipping along channel.
25 7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
26 8. Metallic Coating: Hot-dip galvanized

27 **2.5 FASTENER SYSTEMS**

- 28 A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement
29 concrete, with pull-out, tension, and shear capacities appropriate for supported loads and
30 building materials where used.
- 31 B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland
32 cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads
33 and building materials where used.

34 **2.6 PIPE STANDS**

- 35 A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of
36 manufactured corrosion-resistant components to support roof-mounted piping.
- 37 B. Compact Pipe Stand:
- 38 1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to
39 support pipe, for roof installation without membrane penetration.
40 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
41 3. Hardware: Galvanized steel or polycarbonate.
42 4. Accessories: Protection pads.

- 1 C. Low-Profile, Single-Base, Single-Pipe Stand:
- 2 1. Description: Single base with vertical and horizontal members, and pipe support, for roof
3 installation without membrane protection.
- 4 2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
- 5 3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch (12-mm) rods.
- 6 4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
- 7 5. Pipe Supports: Roller, Strut clamps, or Clevis hanger.
- 8 6. Hardware: Stainless steel.
- 9 7. Accessories: Protection pads.
- 10 8. Height: 12 inches (300 mm) above roof.
- 11 D. High-Profile, Single-Base, Single-Pipe Stand:
- 12 1. Description: Single base, vertical and horizontal members, and pipe support, for roof
13 installation without membrane penetration.
- 14 2. Base: Single vulcanized rubber or molded polypropylene.
- 15 3. Vertical Members: Two galvanized-steel, continuous-thread, 1/2-inch (12-mm) rods.
- 16 4. Horizontal Member: One adjustable-height, galvanized-steel, pipe-support slotted
17 channel or plate.
- 18 5. Pipe Supports: Roller.
- 19 6. Hardware: Stainless steel.
- 20 7. Accessories: Protection pads, 1/2-inch (12-mm), continuous-thread, stainless-steel rod.
- 21 8. Height: 36 inches (900 mm) above roof.
- 22 E. High-Profile, Multiple-Pipe Stand:
- 23 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for
24 roof installation without membrane penetration.
- 25 2. Vertical Members: Two or more, galvanized-steel channels.
- 26 3. Horizontal Members: One or more, adjustable-height, galvanized-steel pipe support.
- 27 4. Pipe Supports: Clevis hanger.
- 28 5. Hardware: Stainless steel.
- 29 6. Accessories: Protection pads, 1/2-inch (12-mm), continuous-thread rod.
- 30 7. Height: 36 inches (900 mm) above roof.

31 2.7 EQUIPMENT SUPPORTS

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

34 2.8 MATERIALS

- 35 A. Aluminum: ASTM B 221 (ASTM B 221M).
- 36 B. Carbon Steel: ASTM A 1011/A 1011M.
- 37 C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and
38 galvanized.
- 39 D. Stainless Steel: ASTM A 240/A 240M.

- 1 E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink
 2 and nonmetallic grout; suitable for interior and exterior applications.
- 3 1. Properties: Non-staining, noncorrosive, and nongaseous.
 4 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

5 **PART 3 - EXECUTION**

6 **3.1 APPLICATION**

- 7 A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for Firestopping
 8 materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.
- 9 B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength
 10 will be adequate to carry present and future static loads within specified loading limits. Minimum
 11 static design load used for strength determination shall be weight of supported components plus
 12 200 lb (90 kg).

13 **3.2 HANGER AND SUPPORT INSTALLATION**

- 14 A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and
 15 attachments as required to properly support piping from building structure.
- 16 B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of
 17 parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
- 18 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or
 19 install intermediate supports for smaller-diameter pipes as specified for individual pipe
 20 hangers.
 21 2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being
 22 supported. Weld steel according to AWS D1.1/D1.1M.
- 23 C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support
 24 together on field-assembled metal framing systems.
- 25 D. Fastener System Installation:
- 26 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less
 27 than 4 inches (100 mm) thick in concrete, after concrete is placed and completely cured.
 28 Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners
 29 according to powder-actuated tool manufacturer's operating manual.
 30 2. Install mechanical-expansion anchors in concrete, after concrete is placed and
 31 completely cured. Install fasteners according to manufacturer's written instructions.
- 32 E. Pipe Stand Installation:
- 33 1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on
 34 smooth roof surface. Do not penetrate roof membrane.
- 35 F. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste
 36 piping connections to each plumbing fixture.

- 1 G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts,
2 washers, and other accessories.
- 3 H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- 4 I. Install hangers and supports to allow controlled thermal and seismic movement of piping
5 systems, to permit freedom of movement between pipe anchors, and to facilitate action of
6 expansion joints, expansion loops, expansion bends, and similar units.
- 7 J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- 8 K. Install building attachments within concrete slabs or attach to structural steel. Install additional
9 attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65)
10 and larger and at changes in direction of piping. Install concrete inserts before concrete is
11 placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.
- 12 L. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses
13 from movement will not be transmitted to connected equipment.
- 14 M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed
15 maximum pipe deflections allowed by ASME B31.9 for building services piping.
- 16 N. Insulated Piping:
- 17 1. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is
18 indicated. Fill interior voids with insulation that matches adjoining insulation.
- 19 2. Install MSS SP-58, Type 40 protective shields on piping. Shields shall span an arc of 180
20 degrees. Secure shield to pipe on both ends with stainless steel bands.
- 21 3. Shield Dimensions for Pipe: Not less than the following:
- 22 a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch
23 (1.22 mm) thick.
- 24 b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
- 25 c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch
26 (1.52 mm) thick.
- 27 d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch
28 (1.91 mm) thick.
- 29 e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch
30 (2.67 mm) thick.

31 **3.3 EQUIPMENT SUPPORTS**

- 32 A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support
33 equipment above floor.
- 34 B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.
- 35 C. Provide lateral bracing, to prevent swaying, for equipment supports.

1 **3.4 METAL FABRICATIONS**

- 2 A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment
3 supports.
- 4 B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be
5 shop welded because of shipping size limitations.
- 6 C. Field Welding: Comply with AWS D1.1 / D1.1M procedures for shielded, metal arc welding;
7 appearance and quality of welds; and methods used in correcting welding work; and with the
8 following:
- 9 1. Use materials and methods that minimize distortion and develop strength and corrosion
10 resistance of base metals.
 - 11 2. Obtain fusion without undercut or overlap.
 - 12 3. Remove welding flux immediately.
 - 13 4. Finish welds at exposed connections, so no roughness shows after finishing and so
14 contours of welded surfaces match adjacent contours.

15 **3.5 ADJUSTING**

- 16 A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve
17 indicated slope of pipe.
- 18 B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

19 **3.6 PAINTING**

- 20 A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately
21 after erecting hangers and supports. Use same materials as those used for shop painting.
22 Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
- 23 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05
24 mm).
- 25 B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded, shop-
26 painted areas on miscellaneous metal are specified in Section 099113.1 "Exterior Painting for
27 Mechanical and Electrical Systems" and Section 099123.1 "Interior Painting for Mechanical and
28 Electrical Systems."
- 29 C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply
30 galvanizing-repair paint to comply with ASTM A 780 / A 780M.

31 **3.7 HANGER AND SUPPORT SCHEDULE**

- 32 A. Specific hanger and support requirements are in Sections specifying piping systems and
33 equipment.
- 34 B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in
35 piping system Sections.

- 1 C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will
2 not have field-applied finishes.
- 3 D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in
4 direct contact with copper tubing.
- 5 E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and metal framing
6 systems and attachments for general service applications.
- 7 F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment
8 applications.
- 9 G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- 10 H. Use padded hangers for piping that is subject to scratching.
- 11 I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in
12 piping system Sections, install the following types:
- 13 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or
14 insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
- 15 2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to
16 NPS 24 (DN 15 to DN 600) if little or no insulation is required.
- 17 3. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to
18 DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel
19 plate.
- 20 J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system
21 Sections, install the following types:
- 22 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to
23 NPS 24 (DN 24 to DN 600).
- 24 K. Saddles and Shields: Unless otherwise indicated and except as specified in piping system
25 Sections, install the following types:
- 26 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with
27 insulation that matches adjoining insulation.
- 28 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to
29 prevent crushing insulation.
- 30 L. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not
31 specified in piping system Sections.
- 32 M. Comply with MFMA-103 for metal framing system selections and applications that are not
33 specified in piping system Sections.
- 34 N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building
35 attachments where required in concrete construction.
- 36 O. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and
37 waste piping for plumbing fixtures.

38 **END OF SECTION 22 05 29**

1 **SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Equipment labels.
9 2. Warning signs and labels.
10 3. Pipe labels.
11 4. Valve tags.
12 5. Warning tags.

13 **1.3 ACTION SUBMITTALS**

- 14 A. Product Data: For each type of product indicated.
- 15 B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed
16 content for each label.
- 17 C. Valve numbering scheme.
- 18 D. Valve Schedules: For each piping system to include in maintenance manuals.

19 **PART 2 - PRODUCTS**

20 **2.1 EQUIPMENT LABELS**

- 21 A. Plastic Labels for Equipment:

- 22
- 23 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving,
24 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
- 25 2. Letter Color: White.
- 26 3. Background Color: Black.
- 27 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- 28 5. Minimum Label Size: Length and width vary for required label content, but not less than
29 2-1/2 by 3/4 inch (64 by 19 mm).
- 30 6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than
31 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm),
32 and proportionately larger lettering for greater viewing distances. Include secondary
33 lettering two-thirds to three-quarters the size of principal lettering.

- 1 7. Fasteners: Stainless-steel rivets.
- 2 8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 3 B. Label Content: Include equipment's Drawing designation or unique equipment number.
- 4 C. Equipment Label Schedule: For each item of equipment to be labeled, tabulate equipment label
- 5 content. Equipment schedule shall be included in operation and maintenance data.

6 **2.2 WARNING SIGNS AND LABELS**

- 7 A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch
- 8 (3.2 mm) thick, and having predrilled holes for attachment hardware.
- 9 B. Letter Color: Black.
- 10 C. Background Color: Yellow.
- 11 D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
- 12 E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by
- 13 3/4 inch (64 by 19 mm).
- 14 F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24
- 15 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and
- 16 proportionately larger lettering for greater viewing distances. Include secondary lettering two-
- 17 thirds to three-quarters the size of principal lettering.
- 18 G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- 19 H. Label Content: Include caution and warning information plus emergency notification instructions.

20 **2.3 PIPE LABELS**

- 21 A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering
- 22 indicating service, and showing flow direction.
- 23 B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- 24 C. Pipe Label Contents: Include identification of piping service using same designations or
- 25 abbreviations as used on Drawings; also include pipe size and an arrow indicating flow
- 26 direction.
- 27 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both
- 28 directions or as separate unit on each pipe label to indicate flow direction.
- 29 2. Lettering Size: Size letters according to ASME A13.1 for piping.

30 **2.4 VALVE TAGS**

- 31 A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation
- 32 and 1/2-inch (13-mm) numbers.

- 1 1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness, and having predrilled or
- 2 stamped holes for attachment hardware.
- 3 2. Fasteners: Brass wire-link chain.

- 4 B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve
- 5 number, piping system, system abbreviation (as shown on valve tag), location of valve (room or
- 6 space), normal-operating position (open, closed, or modulating), and variations for identification.
- 7 Mark valves for emergency shutoff and similar special uses.

- 8 1. Valve-tag schedule shall be included in operation and maintenance data.

9 **2.5 WARNING TAGS**

- 10 A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock
- 11 with matte finish suitable for writing.

- 12 1. Size: Approximately 4 by 7 inches (100 by 178 mm).
- 13 2. Fasteners: Brass grommet and wire.
- 14 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT
- 15 OPERATE."
- 16 4. Color: Safety yellow background with black lettering.

17 **PART 3 - EXECUTION**

18 **3.1 PREPARATION**

- 19 A. Clean piping and equipment surfaces of substances that could impair bond of identification
- 20 devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and
- 21 encapsulants.

22 **3.2 GENERAL INSTALLATION REQUIREMENTS**

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

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

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

27 **3.3 EQUIPMENT LABEL INSTALLATION**

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

- 29 B. Locate equipment labels where accessible and visible.

1 **3.4 PIPE LABEL INSTALLATION**

2 A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings
 3 in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels,
 4 and plenums; and exterior exposed locations as follows:

- 5 1. Near each valve and control device.
- 6 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units.
 7 Where flow pattern is not obvious, mark each pipe at branch.
- 8 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
- 9 4. At access doors, manholes, and similar access points that permit view of concealed
 10 piping.
- 11 5. Near major equipment items and other points of origination and termination.
- 12 6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25
 13 feet (7.6 m) in areas of congested piping and equipment.
- 14 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

15 B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including
 16 pipes where flow is allowed in both directions. Install marker tape with arrows around the entire
 17 circumference of the pipe at the beginning and end of the pipe-label content.

18 C. Pipe Label Color Schedule:

19 1. Low-Pressure Compressed Air Piping:

- 20 a. Background: Safety blue.
- 21 b. Letter Colors: White.

22 2. Domestic Water Piping

- 23 a. Background: Safety green.
- 24 b. Letter Colors: White.

25 3. Sanitary Waste and Storm Drainage Piping:

- 26 a. Background Color: Safety black.
- 27 b. Letter Color: White.

28 **3.5 VALVE-TAG INSTALLATION**

29 A. Install tags on valves and control devices in piping systems, except check valves, valves within
 30 factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering
 31 hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged
 32 valves in a valve schedule.

33 B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and
 34 with captions similar to those indicated in the following subparagraphs:

35 1. Valve-Tag Size and Shape:

- 36 a. Cold Water: 1-1/2 inches (38 mm), round.
- 37 b. Hot Water: 1-1/2 inches (38 mm), round.
- 38 c. Sanitary Waste: 1-1/2 inches (38 mm), round.

- 1 2. Valve-Tag Colors:
- 2 a. Cold Water: Natural.
- 3 b. Hot Water: Natural.

- 4 **3.6 WARNING-TAG INSTALLATION**
- 5 A. Write required message on, and attach warning tags to, equipment and other items where
- 6 required.

- 7 **END OF SECTION 22 05 53**

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1 **SECTION 22 05 93**

2 **TESTING, ADJUSTING, AND BALANCING FOR PLUMBING**

3 **PART 1 - GENERAL**

4 **1.1 RELATED DOCUMENTS**

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

7 **1.2 SUMMARY**

- 8 A. Section Includes:

- 9 1. Balancing Hot Water/Hot Water Recirculation Systems:

- 10 a. Constant-flow plumbing hot water systems.

- 11 B. Related Sections:

- 12 1. Section 019113 "General Commissioning Requirements" for general commissioning
13 process requirements.
14 2. Section 230593 "Testing, Adjusting and Balancing for HVAC"

15 **1.3 DEFINITIONS**

- 16 A. AABC: Associated Air Balance Council.

- 17 B. BAS: Building automation systems.

- 18 C. NEBB: National Environmental Balancing Bureau.

- 19 D. TAB: Testing, adjusting, and balancing.

- 20 E. TABB: Testing, Adjusting, and Balancing Bureau.

- 21 F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

- 22 G. TDH: Total dynamic head.

- 23 H. Special Inspector: An entity engaged to inspect smoke control systems.

24 **1.4 PREINSTALLATION MEETINGS**

- 25 A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies
26 and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14
27 days' advance notice of scheduled meeting time and location.

- 1 1. Minimum Agenda Items:
- 2 a. The Contract Documents examination report.
- 3 b. The TAB plan.
- 4 c. Needs for coordination and cooperation of trades and subcontractors.
- 5 d. Proposed procedures for documentation and communication flow.

6 **1.5 ACTION SUBMITTALS**

- 7 A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that
- 8 the TAB specialist and this Project's TAB team members meet the qualifications specified in
- 9 "Quality Assurance" Article.
- 10 B. Report Format Submittals: Within 60 days of Contractor's Notice to Proceed, submit the
- 11 following as specified in "Preparation" Article.
- 12 1. TAB strategies and step-by-step procedures.
- 13 2. System readiness checklists.

14 **1.6 INFORMATIONAL SUBMITTALS**

- 15 A. Contract Documents Examination Report: Within 60 days of Contractor's Notice to Proceed,
- 16 submit the Contract Documents review report as specified in Part 3.
- 17 B. Examination Report: Submit a summary report of the examination review required in
- 18 "Examination" Article.
- 19 C. Certified TAB reports.
- 20 D. Sample report forms.
- 21 E. Instrument calibration reports, to include the following:
- 22 1. Instrument type and make.
- 23 2. Serial number.
- 24 3. Application.
- 25 4. Dates of use.
- 26 5. Dates of calibration.

27 **1.7 QUALITY ASSURANCE**

- 28 A. TAB Specialists Qualifications: Certified by AABC or NEBB.
- 29 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC or NEBB. A
- 30 TAB Field Supervisor shall be on the project site at all times during TAB work and shall
- 31 have a minimum three years' of TAB experience with air, water, sound, and vibration
- 32 testing.
- 33 a. NEBB: Certified Professional (TAB-CP) or Certified Technician (TAB-CT).
- 34 b. AABC: Certified Test and Balance Engineer (TBE) or Certified Technician.

- 1 2. TAB Technician: Employee of the TAB specialist and certified by AABC or NEBB as a
2 TAB technician.
- 3 a. NEBB: Certified Technician (TAB-CT).
- 4 b. AABC: Certified Technician.
- 5
- 6 B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in
7 ASHRAE 111, Section 4, "Instrumentation."
- 8 C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 -
9 "System Balancing."
- 10 D. Warranty: Comply with the program requirements of either:
- 11 1. AABC National Performance Guaranty.
- 12 2. NEBB Conformance Certification.

13 **1.8 FIELD CONDITIONS**

- 14 A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial
15 Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's
16 operations.

17 **1.9 TAB CONTRACTOR'S RESPONSIBILITIES**

- 18 A. Attend testing, adjusting, and balancing review and coordination meeting.
- 19 B. Participate in verification of the TAB report by the CxA or Engineer for verification and
20 diagnostic purposes.

21 **PART 2 - PRODUCTS (Not Applicable)**

22 **PART 3 - EXECUTION**

23 **3.1 TAB SPECIALISTS**

- 24 A. Subject to compliance with requirements, engage one of the following:
- 25 1. FTS Test and Balance
- 26 a. Location: Tallahassee, Florida
- 27 b. Contact: Heath Allbaugh, CP
- 28 c. Phone Number: (850) 727-5391
- 29 2. HVAC Testing Services, Inc.
- 30 a. Location: Thomasville, Georgia
- 31 b. Contact: Greg Lang, CP / Pete Lang
- 32 c. Phone Number: (229) 227-0255
- 33 3. Indoor Air Professionals, Inc.

- 1 a. Location: Fort Myers, Florida
- 2 b. Contact: Joseph Molloy, III, CP
- 3 c. Phone Number: (239) 707-9732

4 **3.2 EXAMINATION**

- 5 A. Examine the Contract Documents to become familiar with Project requirements and to discover
- 6 conditions in systems designs that may preclude proper TAB of systems and equipment.
- 7 B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer
- 8 wells, flow-control devices, balancing valves and fittings. Verify that locations of these balancing
- 9 devices are applicable for intended purpose and are accessible.
- 10 C. Examine the approved submittals for Plumbing systems and equipment.
- 11 D. Examine design data including plumbing system descriptions, statements of design
- 12 assumptions for hot water/hot water recirculating systems, and statements of philosophies and
- 13 assumptions about plumbing system and equipment controls.
- 14 E. Examine equipment performance data including pump curves.
- 15 1. Relate performance data to Project conditions and requirements, including system effects
- 16 that can create undesired or unpredicted conditions that cause reduced capacities in all
- 17 or part of a system.
- 18 F. Examine system and equipment installations and verify that field quality-control testing,
- 19 cleaning, and adjusting specified in individual Sections have been performed.
- 20 G. Examine test reports specified in individual system and equipment Sections.
- 21 H. Examine strainers. Verify that startup screens have been replaced by permanent screens with
- 22 indicated perforations.
- 23 I. Examine control valves for proper installation for their intended function of throttling, diverting, or
- 24 mixing fluid flows.
- 25 J. Examine system pumps to ensure absence of entrained air in the suction piping.
- 26 K. Examine operating safety interlocks and controls on plumbing equipment.
- 27 L. Report deficiencies discovered before and during performance of TAB procedures. Observe
- 28 and record system reactions to changes in conditions. Record default set points if different from
- 29 indicated values.

30 **3.3 PREPARATION**

- 31 A. Prepare a TAB plan that includes the following:
- 32 1. Equipment and systems to be tested.
- 33 2. Strategies and step-by-step procedures for balancing the systems.
- 34 3. Instrumentation to be used.
- 35 4. Project specific forms with specific identification for all equipment and systems. Project
- 36 specific forms shall include design data for all equipment and systems to be tested and

1 descriptions of any other necessary supporting data required in the final report that will be
 2 included (i.e. pump curves, layout drawings, balancing valve charts, etc).

3 B. Perform system-readiness checks of plumbing systems and equipment to verify system
 4 readiness for TAB work. Include, at a minimum, the following:

5 1. Hydronics:

- 6 a. Verify leakage and pressure tests on water distribution systems have been
 7 satisfactorily completed.
- 8 b. Piping is complete.
- 9 c. Systems are flushed.
- 10 d. Strainers are pulled and cleaned.
- 11 e. Control valves are functioning per the sequence of operation.
- 12 f. Shutoff and balance valves have been verified to be 100 percent open.
- 13 g. Pumps are started and proper rotation is verified.
- 14 h. Pump gage connections are installed directly at pump inlet and outlet flanges or in
 15 discharge and suction pipe prior to valves or strainers.
- 16 i. Suitable access to balancing devices and equipment is provided.

17 **3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING**

18 A. Perform testing and balancing procedures on each system according to the procedures
 19 contained in AABC's "National Standards for Total System Balance", ASHRAE 111, or NEBB's
 20 "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" , and in
 21 this Section.

22 B. Mark equipment and balancing devices, valve position indicators, and similar controls and
 23 devices, with paint or other suitable, permanent identification material to show final settings.

24 C. Take and report testing and balancing measurements in inch-pound (IP) units.

25 **3.5 GENERAL PROCEDURES FOR DOMESTIC HOT WATER SYSTEMS**

26 A. Prepare test reports for pumps, and heat exchangers. Obtain approved submittals and
 27 manufacturer-recommended testing procedures. Crosscheck the summation of required coil
 28 and heat exchanger flow rates with pump design flow rate.

29 B. Prepare schematic diagrams of systems' "as-built" piping layouts.

30 C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and
 31 balancing as follows:

- 32 1. Check liquid level in expansion tank.
- 33 2. Check highest vent for adequate pressure.
- 34 3. Check balancing valves for proper position.
- 35 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- 36 5. Check that air has been purged from the system.

37 **3.6 PROCEDURES FOR CONSTANT-FLOW HOT WATER RECIRCULATING SYSTEMS**

38 A. Adjust pumps to deliver total design gpm.

- 1 1. Measure total water flow.
 - 2 a. Position valves for full flow through recirculation loop.
 - 3 b. Measure flow by main flow meter, if installed.
 - 4 c. If main flow meter is not installed, determine flow by pump TDH or exchanger
 - 5 pressure drop.

- 6 2. Measure pump TDH as follows:
 - 7 a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe
 - 8 prior to any valves.
 - 9 b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to
 - 10 any valves or strainers.
 - 11 c. Convert pressure to head and correct for differences in gage heights.
 - 12 d. Verify pump impeller size by measuring the TDH with the discharge valve closed.
 - 13 Note the point on manufacturer's pump curve at zero flow, and verify that the pump
 - 14 has the intended impeller size.
 - 15 1) If impeller sizes must be adjusted to achieve pump performance, obtain
 - 16 approval from Engineer and comply with requirements of Division 23
 - 17 Section "Hydronic Pumps".
 - 18 e. With valves open, read pump TDH. Adjust pump discharge valve until design water
 - 19 flow is achieved.

- 20 3. Monitor motor performance during procedures and do not operate motor in an overloaded
- 21 condition.

- 22 B. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - 23 1. Measure flow in main and branch pipes.
 - 24 2. Adjust main and branch balance valves for design flow.
 - 25 3. Re-measure each main and branch after all have been adjusted.

- 26 C. Verify final system conditions as follows:
 - 27 1. Re-measure and confirm that total water flow is within design.
 - 28 2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - 29 3. Mark final settings.
 - 30 4. Mark pump manufacturer's head-capacity curve.

- 31 D. Verify that memory stops have been set.

32 3.7 PROCEDURES FOR MOTORS

- 33 A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 - 34 1. Manufacturer's name, model number, and serial number.
 - 35 2. Motor horsepower rating.
 - 36 3. Motor rpm.
 - 37 4. Phase and hertz.
 - 38 5. Nameplate and measured voltage, each phase.
 - 39 6. Nameplate and measured amperage, each phase.
 - 40 7. Starter size and thermal-protection-element rating.

- 1 8. Service factor and frame size.
- 2 B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove
- 3 proper operation.

4 **3.8 PROCEDURES FOR BOILERS**

- 5 A. Domestic Hot Water Boilers:
- 6 1. Measure and record entering- and leaving-water temperatures.
- 7 2. Measure and record water flow and pressure.
- 8 3. Record relief valve pressure setting.

9 **3.9 CONTROLS VERIFICATION**

- 10 A. In conjunction with system balancing, perform the following:
- 11 1. Verify temperature control system is operating within the design limitations.
- 12 2. Verify that controlled devices are properly installed and connected to correct controller.
- 13 3. Verify location and installation of sensors to ensure that they sense only intended
- 14 temperature, humidity, or pressure.
- 15 B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations
- 16 from indicated conditions.

17 **3.10 TOLERANCES**

- 18 A. Set plumbing system's water flow rates within the following tolerances:
- 19 1. Water Flow Rate: Plus or minus 10 percent.
- 20 B. Maintaining pressure relationships as designed shall have priority over the tolerances specified
- 21 above.

22 **3.11 PROGRESS REPORTING**

- 23 A. Initial Construction-Phase Report: Based on examination of the Contract Documents as
- 24 specified in "Examination" Article, prepare a report on the adequacy of design for systems
- 25 balancing devices. Recommend changes and additions to systems balancing devices to
- 26 facilitate proper performance measuring and balancing. Recommend changes and additions to
- 27 plumbing systems and general construction to allow access for performance measuring and
- 28 balancing devices.
- 29 B. Status Reports: Prepare weekly progress reports to describe completed procedures,
- 30 procedures in progress, and scheduled procedures. Include a list of deficiencies and problems
- 31 found in systems being tested and balanced. Prepare a separate report for each system and
- 32 each building floor for systems serving multiple floors.

- 1 a. Motor make, and frame type and size.
 - 2 b. Horsepower and rpm.
 - 3 c. Volts, phase, and hertz.
 - 4 d. Full-load amperage and service factor.
 - 5 e. Sheave make, size in inches (mm), and bore.
 - 6 f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
- 7 E. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup
8 equipment reports, include the following:
- 9 1. Unit Data:
 - 10 a. System identification.
 - 11 b. Location.
 - 12 c. Make and type.
 - 13 d. Model number and unit size.
 - 14 e. Manufacturer's serial number.
 - 15 f. Fuel type in input data.
 - 16 g. Output capacity in Btu/h (kW).
 - 17 h. Ignition type.
 - 18 i. Burner-control types.
- 19 F. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and
20 include the following:
- 21 1. Unit Data:
 - 22 a. Unit identification.
 - 23 b. Location.
 - 24 c. Service.
 - 25 d. Make and size.
 - 26 e. Model number and serial number.
 - 27 f. Water flow rate in gpm (L/s).
 - 28 g. Water pressure differential in feet of head or psig (kPa).
 - 29 h. Pump rpm.
 - 30 i. Impeller diameter in inches (mm).
 - 31 j. Motor make and frame size.
 - 32 k. Motor horsepower and rpm.
 - 33 l. Voltage at each connection.
 - 34 m. Amperage for each phase.
 - 35 n. Full-load amperage and service factor.
 - 36 o. Seal type.
 - 37 2. Test Data (Indicated and Actual Values):
 - 38 a. Static head in feet of head or psig (kPa).
 - 39 b. Pump shutoff pressure in feet of head or psig (kPa).
 - 40 c. Actual impeller size in inches (mm).
 - 41 d. Full-open flow rate in gpm (L/s).
 - 42 e. Full-open pressure in feet of head or psig (kPa).
 - 43 f. Final discharge pressure in feet of head or psig (kPa).
 - 44 g. Final suction pressure in feet of head or psig (kPa).
 - 45 h. Final total pressure in feet of head or psig (kPa).
 - 46 i. Final water flow rate in gpm (L/s).
 - 47 j. Voltage at each connection.
 - 48 k. Amperage for each phase.

1 G. Instrument Calibration Reports:

2 1. Report Data:

- 3 a. Instrument type and make.
- 4 b. Serial number.
- 5 c. Application.
- 6 d. Dates of use.
- 7 e. Dates of calibration.

8 **3.13 VERIFICATION OF TAB REPORT**

9 A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of
 10 Engineer. The TAB Contractor shall include within his bid price an allowance for 8 hours of time
 11 to meet with the Engineer for the purpose of verifying the TAB results. Time for the Engineer
 12 shall be charged at \$120.00 per hour and billed directly to the TAB Contractor from the
 13 Engineer.

14 B. At Engineer's option, Engineer shall randomly select measurements, documented in the final
 15 report, to be rechecked. Rechecking shall be limited to either 10 percent of the total
 16 measurements recorded or the extent of measurements that can be accomplished in a normal
 17 8-hour business day.

18 C. If rechecks yield measurements that differ from the measurements documented in the final
 19 report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

20 D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements
 21 checked during the final inspection, the testing and balancing shall be considered incomplete
 22 and shall be rejected.

23 E. If TAB work fails, proceed as follows:

- 24 1. TAB specialists shall recheck all measurements and make adjustments. Revise the final
 25 report and balancing device settings to include all changes; resubmit the final report and
 26 request a second final inspection.
- 27 2. If the second final inspection also fails, Owner may contract the services of another TAB
 28 specialist to complete TAB work according to the Contract Documents and deduct the
 29 cost of the services from the original TAB specialist's final payment.
- 30 3. If the second verification also fails, design professional may contact AABC Headquarters
 31 regarding the AABC National Performance Guaranty or NEBB Headquarters regarding
 32 the NEBB Conformance Certification.

33 F. Prepare test and inspection reports.

34 **3.14 ADDITIONAL TESTS**

35 A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are
 36 being maintained throughout and to correct unusual conditions.

37 B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and
 38 winter conditions, perform additional TAB during near-peak summer and winter conditions.

1 **END OF SECTION 22 05 93**

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1 **SECTION 22 07 19.12 - INSULATION FOR DOMESTIC HOT-WATER PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section includes insulating the following plumbing piping services:
8 1. Domestic hot-water piping.
9 2. Domestic recirculating hot-water piping.

10 **1.3 ACTION SUBMITTALS**

- 11 A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor
12 permeance thickness, and jackets (both factory- and field-applied, if any).

- 13 B. Shop Drawings:

- 14 1. Detail application of protective shields, saddles, and inserts at hangers for each type of
15 insulation and hanger.
16 2. Detail attachment and covering of heat tracing inside insulation where applicable.
17 3. Detail insulation application at pipe expansion joints for each type of insulation.
18 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each
19 type of insulation.
20 5. Detail removable insulation at piping specialties, equipment connections, and access
21 panels.
22 6. Detail application of field-applied jackets.
23 7. Detail application at linkages of control devices.

24 **1.4 QUALITY ASSURANCE**

- 25 A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship
26 program or another craft training program certified by the Department of Labor, Bureau of
27 Apprenticeship and Training.

- 28 B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing
29 identical products according to ASTM E84 by a testing agency acceptable to authorities having
30 jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and
31 cement material containers, with appropriate markings of applicable testing agency.

- 32 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed
33 index of 50 or less.
34 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed
35 index of 150 or less.

1 C. Comply with the following applicable standards and other requirements specified for
2 miscellaneous components:

3 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

4 **1.5 DELIVERY, STORAGE, AND HANDLING**

5 A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate
6 ASTM standard designation, type and grade, and maximum use temperature.

7 **1.6 COORDINATION**

8 A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in
9 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

10 B. Coordinate clearance requirements with piping Installer for piping insulation application. Before
11 preparing piping Shop Drawings, establish and maintain clearance requirements for installation
12 of insulation and field-applied jackets and finishes and for space required for maintenance.

13 C. Coordinate installation and testing of heat tracing, where applicable.

14 **1.7 SCHEDULING**

15 A. Schedule insulation application after pressure testing systems and, where required, after
16 installing and testing heat tracing. Insulation application may begin on segments that have
17 satisfactory test results.

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

20 **PART 2 - PRODUCTS**

21 **2.1 INSULATION MATERIALS**

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

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

26 C. Products that come in contact with stainless steel shall have a leachable chloride content of less
27 than 50 ppm when tested according to ASTM C871.

28 D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable
29 according to ASTM C795.

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

- 1 F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid,
2 hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied
3 Jackets" Article.
- 4 1. Products: Subject to compliance with requirements, available products that may be
5 incorporated into the Work include, but are not limited to, the following:
- 6 a. Pittsburgh Corning Corporation; Foamglas.
- 7 2. Block Insulation: ASTM C552, Type I.
- 8 3. Special-Shaped Insulation: ASTM C552, Type III.
- 9 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C552, Type II, Class 1.
- 10 5. Preformed Pipe Insulation with Factory-Applied ASJ-SSL: Comply with ASTM C552,
11 Type II, Class 2.
- 12 6. Factory fabricate shapes according to ASTM C450 and ASTM C585.
- 13 G. Mineral-Fiber, Preformed Pipe Insulation:
- 14 1. Products: Subject to compliance with requirements, provide one of the following:
- 15 a. Johns Manville; Micro-Lok.
- 16 b. Knauf Insulation; 1000-Degree Pipe Insulation.
- 17 c. Owens Corning; Fiberglas Pipe Insulation.
- 18 2. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a
19 thermosetting resin. Comply with ASTM C547, Type I, Grade A, with factory-applied ASJ-
20 SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets"
21 Article.

22 **2.2 INSULATING CEMENTS**

- 23 A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.
- 24 1. Products: Subject to compliance with requirements, available products that may be
25 incorporated into the Work include, but are not limited to, the following:
- 26 a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

27 **2.3 ADHESIVES**

- 28 A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding
29 insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- 30 B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no
31 flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73
32 to plus 93 deg C).
- 33 1. Products: Subject to compliance with requirements, available products that may be
34 incorporated into the Work include, but are not limited to, the following:
- 35 a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
36 Company; 81-84.

- 1 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when
- 2 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 3 3. Adhesive shall comply with the testing and product requirements of the California
- 4 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 5 Emissions from Various Sources Using Small-Scale Environmental Chambers."

6 C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

- 7 1. Products: Subject to compliance with requirements, provide one of the following:
- 8 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 9 Company; CP-127.
- 10 b. Eagle Bridges - Marathon Industries; 225.
- 11 c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 12 Company; 85-60/85-70.
- 13 d. Mon-Eco Industries, Inc.; 22-25.
- 14 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when
- 15 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 16 3. Adhesive shall comply with the testing and product requirements of the California
- 17 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 18 Emissions from Various Sources Using Small-Scale Environmental Chambers."

19 D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap

20 seams and joints.

- 21 1. Products: Subject to compliance with requirements, provide one of the following:
- 22 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 23 Company; CP-82.
- 24 b. Eagle Bridges - Marathon Industries; 225.
- 25 c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 26 Company; 85-20.
- 27 d. Mon-Eco Industries, Inc.; 22-25.
- 28 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when
- 29 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 30 3. Adhesive shall comply with the testing and product requirements of the California
- 31 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 32 Emissions from Various Sources Using Small-Scale Environmental Chambers."

33 **2.4 MASTICS AND COATINGS**

- 34 A. Materials shall be compatible with insulation materials, jackets, and substrates.
- 35 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when
- 36 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 37 B. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
- 38 1. Products: Subject to compliance with requirements, provide one of the following:
- 39 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 40 Company; CP-10.

- 1 b. Eagle Bridges - Marathon Industries; 550.
- 2 c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 3 Company; 46-50.
- 4 d. Mon-Eco Industries, Inc.; 55-50.
- 5 e. Vimasco Corporation; WC-1/WC-5.

- 6 2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm (0.66 metric perms) at
- 7 manufacturer's recommended dry film thickness.
- 8 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- 9 4. Color: White.

10 **2.5 SEALANTS**

11 A. Joint Sealants for Cellular-Glass Products:

- 12 1. Subject to compliance with requirements, provide one of the following:

- 13 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 14 Company; CP-76.
- 15 b. Eagle Bridges - Marathon Industries; 405.
- 16 c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 17 Company; 30-45.
- 18 d. Mon-Eco Industries, Inc.; 44-05.

- 19 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 20 3. Permanently flexible, elastomeric sealant.
- 21 4. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
- 22 5. Color: White or gray.
- 23 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when
- 24 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 25 7. Sealants shall comply with the testing and product requirements of the California
- 26 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 27 Emissions from Various Sources Using Small-Scale Environmental Chambers."

28 B. Metal Jacket Flashing Sealants:

- 29 1. Products: Subject to compliance with requirements, provide one of the following:

- 30 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 31 Company; CP-76.
- 32 b. Eagle Bridges - Marathon Industries; 405.
- 33 c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 34 Company; 95-44.
- 35 d. Mon-Eco Industries, Inc.; 44-05.

- 36 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 37 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 38 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
- 39 5. Color: Aluminum.
- 40 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when
- 41 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 42 7. Sealants shall comply with the testing and product requirements of the California
- 43 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 44 Emissions from Various Sources Using Small-Scale Environmental Chambers."

- 1 C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
- 2 1. Products: Subject to compliance with requirements, available products that may be
- 3 incorporated into the Work include, but are not limited to, the following:
- 4 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 5 Company; CP-76.
- 6 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 7 3. Fire- and water-resistant, flexible, elastomeric sealant.
- 8 4. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
- 9 5. Color: White.
- 10 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when
- 11 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 12 7. Sealants shall comply with the testing and product requirements of the California
- 13 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 14 Emissions from Various Sources Using Small-Scale Environmental Chambers."

15 **2.6 FACTORY-APPLIED JACKETS**

- 16 A. Insulation system schedules indicate factory-applied jackets on various applications. When
- 17 factory-applied jackets are indicated, comply with the following:
- 18 1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a
- 19 removable protective strip; complying with ASTM C1136, Type I.

20 **2.7 FIELD-APPLIED FABRIC-REINFORCING MESH**

- 21 A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. (68 g/sq. m) with a thread count of 10
- 22 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm) for covering pipe and pipe fittings.
- 23 1. Products: Subject to compliance with requirements, available products that may be
- 24 incorporated into the Work include, but are not limited to, the following:
- 25 a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 26 Company; Chil-Glas Number 10.

27 **2.8 FIELD-APPLIED JACKETS**

- 28 A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.
- 29 B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784,
- 30 Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming.
- 31 Thickness is indicated in field-applied jacket schedules.
- 32 1. Products: Subject to compliance with requirements, provide one of the following:
- 33 a. Johns Manville; Zeston.
- 34 b. P.I.C. Plastics, Inc.; FG Series.
- 35 c. Proto Corporation; LoSmoke.
- 36 d. Speedline Corporation; SmokeSafe.

- 1 2. Adhesive: As recommended by jacket material manufacturer.
- 2 3. Color: White.
- 3 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

- 4 a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges,
- 5 unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap
- 6 and supply covers for lavatories.

- 7 C. Metal Jacket:

- 8 1. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or
- 9 5005, Temper H-14.

- 10 a. Factory cut and rolled to size.
- 11 b. Finish and thickness are indicated in field-applied jacket schedules.
- 12 c. Moisture Barrier for Indoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
- 13 d. Moisture Barrier for Outdoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
- 14 e. Factory-Fabricated Fitting Covers:

- 15 1) Same material, finish, and thickness as jacket.
- 16 2) Field fabricate fitting covers only if factory-fabricated fitting covers are not
- 17 available.

18 **2.9 TAPES**

- 19 A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive,
- 20 complying with ASTM C1136.

- 21 1. Width: 3 inches (75 mm).
- 22 2. Thickness: 11.5 mils (0.29 mm).
- 23 3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
- 24 4. Elongation: 2 percent.
- 25 5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
- 26 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- 27 B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive;
- 28 suitable for indoor and outdoor applications.

- 29 1. Width: 2 inches (50 mm).
- 30 2. Thickness: 6 mils (0.15 mm).
- 31 3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
- 32 4. Elongation: 500 percent.
- 33 5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

34 **2.10 SECUREMENTS**

- 35 A. Bands:

- 36 1. Products: Subject to compliance with requirements, provide one of the following:

- 37 a. ITW Insulation Systems; Gerrard Strapping and Seals.
- 38 b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

- 1 2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; 0.015 inch (0.38 mm)
2 thick, 1/2 inch (13 mm) wide with wing seal.
- 3 B. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

4 **PART 3 - EXECUTION**

5 **3.1 EXAMINATION**

- 6 A. Examine substrates and conditions for compliance with requirements for installation tolerances
7 and other conditions affecting performance of insulation application.
- 8 1. Verify that systems to be insulated have been tested and are free of defects.
9 2. Verify that surfaces to be insulated are clean and dry.
- 10 B. Proceed with installation only after unsatisfactory conditions have been corrected.

11 **3.2 PREPARATION**

- 12 A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will
13 adversely affect insulation application.
- 14 B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements
15 for heat tracing that apply to insulation.
- 16 C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with
17 stainless-steel surfaces, use demineralized water.

18 **3.3 GENERAL INSTALLATION REQUIREMENTS**

- 19 A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces;
20 free of voids throughout the length of piping including fittings, valves, and specialties.
- 21 B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required
22 for each item of pipe system as specified in insulation system schedules.
- 23 C. Install accessories compatible with insulation materials and suitable for the service. Install
24 accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or
25 dry state.
- 26 D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- 27 E. Install multiple layers of insulation with longitudinal and end seams staggered.
- 28 F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- 29 G. Keep insulation materials dry during application and finishing.
- 30 H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with
31 adhesive recommended by insulation material manufacturer.

- 1 I. Install insulation with least number of joints practical.
- 2 J. Above Ambient Systems:
 - 3 1. Where mastic is indicated provide breather mastic.
 - 4 2. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with
 - 5 continuous thermal integrity unless otherwise indicated.
 - 6 3. Install insulation continuously through hangers and around anchor attachments.
- 7 K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet
- 8 and dry film thicknesses.
- 9 L. Install insulation with factory-applied jackets as follows:
 - 10 1. Draw jacket tight and smooth.
 - 11 2. Cover joints and seams with tape, according to insulation material manufacturer's written
 - 12 instructions, to maintain vapor seal.
- 13 M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal
- 14 thickness.
- 15 N. Repair damaged insulation facings by applying same facing material over damaged areas.
- 16 Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal
- 17 patches similar to butt joints.
- 18 O. For above-ambient services, do not install insulation to the following:
 - 19 1. Vibration-control devices.
 - 20 2. Testing agency labels and stamps.
 - 21 3. Nameplates and data plates.
 - 22 4. Cleanouts.

23 3.4 PENETRATIONS

- 24 A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof
- 25 penetrations.
 - 26 1. Seal penetrations with flashing sealant.
 - 27 2. For applications requiring only indoor insulation, terminate insulation above roof surface
 - 28 and seal with joint sealant. For applications requiring indoor and outdoor insulation, install
 - 29 insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with
 - 30 joint sealant.
 - 31 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below
 - 32 top of roof flashing.
 - 33 4. Seal jacket to roof flashing with flashing sealant.
- 34 B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with
- 35 sleeve seal. Seal terminations with flashing sealant.
- 36 C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously
- 37 through wall penetrations.
 - 38 1. Seal penetrations with flashing sealant.

- 1 2. For applications requiring only indoor insulation, terminate insulation inside wall surface
- 2 and seal with joint sealant. For applications requiring indoor and outdoor insulation, install
- 3 insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with
- 4 joint sealant.
- 5 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least
- 6 2 inches (50 mm).
- 7 4. Seal jacket to wall flashing with flashing sealant.

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

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

- 12 1. Comply with requirements for firestopping and fire-resistive joint sealers.

- 13 F. Insulation Installation at Floor Penetrations:

- 14 1. Pipe: Install insulation continuously through floor penetrations.
- 15 2. Seal penetrations through fire-rated assemblies.

16 **3.5 INSTALLATION OF CELLULAR-GLASS INSULATION**

- 17 A. Insulation Installation on Straight Pipes and Tubes:

- 18 1. Provide factory applied ASJ-SSL jacket.
- 19 2. Create a water stop between insulation and pipe by brushing vapor barrier mastic on pipe
- 20 around circumference of pipe every 3 feet.

- 21 B. Insulation Installation on Pipe Flanges, Fittings, Elbows, Valves and Pipe Specialties:

- 22 1. Provide insulation without factory applied jacket.
- 23 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same
- 24 material and density as adjacent pipe insulation. Each piece shall be butted tightly
- 25 against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular
- 26 surfaces with insulating cement finished to a smooth, hard, and uniform contour that is
- 27 uniform with adjoining pipe insulation.
- 28 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same
- 29 material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt
- 30 each section closely to the next and hold in place with tie wire. Bond pieces with
- 31 adhesive.
- 32 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same
- 33 material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe
- 34 insulation by not less than two times the thickness of pipe insulation, or one pipe
- 35 diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve
- 36 stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with
- 37 insulating cement.
- 38 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same
- 39 material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe
- 40 insulation by not less than two times the thickness of pipe insulation, or one pipe
- 41 diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating
- 42 cement. Insulate strainers so strainer basket flange or plug can be easily removed and
- 43 replaced without damaging the insulation and jacket. Provide a removable reusable
- 44 insulation cover. Provide a design that maintains vapor barrier.

- 1 6. Insulate flanges and unions using a section of oversized preformed pipe insulation.
- 2 Install preformed pipe insulation to outer diameter of pipe flange. Overlap adjoining pipe
- 3 insulation by not less than two times the thickness of pipe insulation, or one pipe
- 4 diameter, whichever is thicker. Fill voids between inner circumference of flange
- 5 insulation and outer circumference of adjacent straight pipe segments with insulating
- 6 cement.
- 7 7. Secure mitered sections or segmented insulation with wire or bands.
- 8 8. Cover pipe fittings, valves, strainers, flanges, unions, and other specialties and any
- 9 segmented insulated surfaces with a layer of finishing cement and install field-applied
- 10 glass-cloth jacket.
- 11 9. Apply vapor-barrier mastic at exposed ends of insulation at pipe flanges, unions, and
- 12 fittings.
- 13 10. Stencil or label the outside insulation jacket of each union with the word "union." Match
- 14 size and color of pipe labels.
- 15

16 C. Insulation Installation on Pipe Fittings and Elbows:

- 17 1. Install preformed sections of same material as straight segments of pipe insulation when
- 18 available. Secure according to manufacturer's written instructions.
- 19 2. When preformed sections of insulation are not available, install mitered sections of
- 20 cellular-glass insulation. Secure insulation materials with wire or bands.

21 D. Insulation Installation on Valves and Pipe Specialties:

- 22 1. Install preformed sections of cellular-glass insulation to valve body.
- 23 2. Arrange insulation to permit access to packing and to allow valve operation without
- 24 disturbing insulation.
- 25 3. Install insulation to flanges as specified for flange insulation application.

26 **3.6 INSTALLATION OF MINERAL-FIBER INSULATION**

27 A. Insulation Installation on Straight Pipes and Tubes:

- 28 1. Provide factory applied ASJ-SSL jacket.

29 B. Insulation Installation on Pipe Flanges, Fittings, Elbows, Valves and Pipe Specialties:

- 30 1. Insulate pipe elbows and tee fittings using preformed fitting insulation. Each piece shall
- 31 be butted tightly against adjoining piece.
- 32 2. Insulate flanges and unions using a section of oversized preformed pipe insulation. Install
- 33 preformed pipe insulation to outer diameter of pipe flange. Overlap adjoining pipe
- 34 insulation by not less than two times the thickness of pipe insulation, or one pipe
- 35 diameter, whichever is thicker. Fill voids between inner circumference of flange
- 36 insulation and outer circumference of adjacent straight pipe segments with insulating
- 37 cement.
- 38 3. Insulate strainers, valves, and other pipe specialties using preformed fitting insulation.
- 39 When preformed sections are not available, install mitered sections of pipe insulation.
- 40 Secure mitered sections with wire or bands.
- 41 4. Arrange valve insulation to permit access to packing and to allow valve operation without
- 42 disturbing insulation.
- 43 5. In concealed locations install fitted PVC cover over preformed fitting insulation. Terminate
- 44 ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC
- 45 tape.

- 1 6. Cover pipe fittings, valves, strainers, flanges, unions, and other specialties in exposed
- 2 locations and any segmented insulated surfaces with a layer of finishing cement and
- 3 install field-applied glass-cloth jacket.
- 4 7. Apply breather mastic at exposed ends of insulation at pipe flanges, unions, and fittings.
- 5 8. Stencil or label the outside insulation jacket of each union with the word "union." Match
- 6 size and color of pipe labels.

7 C. Insulation Installation on Instrument Connections:

- 8 1. Install insulation on instrument connections for thermometers, pressure gages, pressure
- 9 temperature taps, test connections, flow meters, sensors, switches, and transmitters on
- 10 insulated pipes.
- 11 2. Shape insulation at these connections by tapering it to and around the connection with
- 12 insulating cement and finish with mastic.
- 13 3. Secure insulation materials and seal seams with manufacturer's recommended adhesive
- 14 to eliminate openings in insulation that allow passage of air to surface being insulated.

15 **3.7 FIELD-APPLIED JACKET INSTALLATION**

16 A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with

17 factory-applied jackets.

- 18 1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
- 19 2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of mastic.
- 20 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- 21 4. Finish to achieve smooth, uniform finish.

22 B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and

23 end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with

24 weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-

25 steel bands 12 inches (300 mm) o.c. and at end joints.

- 26 1. Do not install metal jacket over glass-cloth jacket.

27 **3.8 FINISHES**

28 A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint

29 system identified below. Color per schedule below.

- 30 1. Semi-gloss Acrylic Finish: Two finish coats over a primer that is compatible with jacket
- 31 material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

32 a. Finish Coat Material: Interior, semi-gloss, latex-emulsion size.

- 33 2. Paint exposed piping without field applied metal jacket.

34 B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of

35 insulation manufacturer's recommended protective coating. Color per schedule below.

36 C. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection

37 of the completed Work.

- 38 1. White.

1 D. Do not field paint aluminum jackets.

2 **3.9 PIPING INSULATION SCHEDULE, GENERAL**

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

6 **3.10 INDOOR PIPING INSULATION SCHEDULE**

7 A. Domestic Hot and Recirculated Hot Water:

8 1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be the following:

9 a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.

10 2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be the following:

11 a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.

12 **3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

13 A. Domestic Hot and Recirculated Hot Water:

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

15 a. Cellular Glass: 2 inches (50 mm) thick.

16 **3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

17 A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-
 18 applied jacket over the factory-applied jacket.

19 B. If more than one material is listed, selection from materials listed is Contractor's option.

20 C. Piping, Concealed:

21 1. None.

22 D. Piping, Exposed:

23 1. Aluminum, Corrugated: 0.016 inch (0.41 mm) thick.

24 E. Exposed fittings, valves, strainers, flanges, unions, and other specialties:

25 1. Glass cloth jacket.

1 **3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE**

2 A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-
3 applied jacket over the factory-applied jacket.

4 B. If more than one material is listed, selection from materials listed is Contractor's option.

5 C. Piping, Concealed:

6 1. Aluminum, Corrugated: 0.024 inch (0.61 mm) thick.

7 D. Piping, Exposed:

8 1. Aluminum, Corrugated: 0.024 inch (0.61 mm) thick.

9 **END OF SECTION 22 07 19.12**

1 **SECTION 22 07 19.13 - INSULATION FOR STORM-WATER PIPING AND DRAINS**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section includes insulating the following plumbing piping services:
8 1. Roof drains and rainwater leaders.
9 2. Floor drains, traps, and drain piping receiving condensate and equipment drain water
10 below 60 deg F

11 **1.3 ACTION SUBMITTALS**

- 12 A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor
13 permeance thickness, and jackets (both factory- and field-applied, if any).

- 14 B. Shop Drawings:

- 15 1. Detail application of protective shields, saddles, and inserts at hangers for each type of
16 insulation and hanger.
17 2. Detail attachment and covering of heat tracing inside insulation where applicable.
18 3. Detail insulation application at pipe expansion joints for each type of insulation.
19 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each
20 type of insulation.
21 5. Detail removable insulation at piping specialties, equipment connections, and access
22 panels.
23 6. Detail application of field-applied jackets.
24 7. Detail application at linkages of control devices.

25 **1.4 QUALITY ASSURANCE**

- 26 A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship
27 program or another craft training program certified by the Department of Labor, Bureau of
28 Apprenticeship and Training.

- 29 B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing
30 identical products according to ASTM E84 by a testing agency acceptable to authorities having
31 jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and
32 cement material containers, with appropriate markings of applicable testing agency.

- 33 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed
34 index of 50 or less.
35 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed
36 index of 150 or less.

1 C. Comply with the following applicable standards and other requirements specified for
2 miscellaneous components:

3 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

4 **1.5 DELIVERY, STORAGE, AND HANDLING**

5 A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate
6 ASTM standard designation, type and grade, and maximum use temperature.

7 **1.6 COORDINATION**

8 A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in
9 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

10 B. Coordinate clearance requirements with piping Installer for piping insulation application. Before
11 preparing piping Shop Drawings, establish and maintain clearance requirements for installation
12 of insulation and field-applied jackets and finishes and for space required for maintenance.

13 C. Coordinate installation and testing of heat tracing, where applicable.

14 **1.7 SCHEDULING**

15 A. Schedule insulation application after pressure testing systems and, where required, after
16 installing and testing heat tracing. Insulation application may begin on segments that have
17 satisfactory test results.

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

20 **PART 2 - PRODUCTS**

21 **2.1 INSULATION MATERIALS**

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

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

26 C. Products that come in contact with stainless steel shall have a leachable chloride content of less
27 than 50 ppm when tested according to ASTM C871.

28 D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable
29 according to ASTM C795.

30 E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply
31 with ASTM C534, Type I for tubular materials.

32 1. Products: Subject to compliance with requirements, provide one of the following:

- 1 a. Aeroflex USA, Inc.; Aerocel.
- 2 b. Armacell LLC; AP Armaflex.
- 3 c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

4 **2.2 ADHESIVES**

- 5 A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding
- 6 insulation to itself and to surfaces to be insulated, unless otherwise indicated.

- 7 B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

- 8 1. Products: Subject to compliance with requirements, provide one of the following:

- 9 a. Aeroflex USA, Inc.; Aero seal.
- 10 b. Armacell LLC; Armaflex 520 Adhesive.
- 11 c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 12 Company; 85-75.
- 13 d. K-Flex USA; R-373 Contact Adhesive.

- 14 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when
- 15 calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 16 3. Adhesive shall comply with the testing and product requirements of the California
- 17 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 18 Emissions from Various Sources Using Small-Scale Environmental Chambers."

19 **2.3 MASTICS AND COATINGS**

- 20 A. Materials shall be compatible with insulation materials, jackets, and substrates.

- 21 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when
- 22 calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- 23 B. Vapor-Retarder Mastic: Water based; suitable for indoor use on below-ambient services.

- 24 1. Products: Subject to compliance with requirements, provide one of the following:

- 25 a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller
- 26 Company; 30-80/30-90.
- 27 b. Vimasco Corporation; 749.

- 28 2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation
- 29 type and service conditions.
- 30 3. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
- 31 4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
- 32 5. Color: White.

33 **2.4 FIELD-APPLIED JACKETS**

- 34 A. Field-applied jackets shall comply with ASTM C921, Type I, unless otherwise indicated.

- 35 B. Metal Jacket:

- 1 1. Aluminum Jacket: Comply with ASTM B209 (ASTM B209M), Alloy 3003, 3005, 3105, or
 2 5005, Temper H-14.
- 3 a. Factory cut and rolled to size.
 4 b. Finish and thickness are indicated in field-applied jacket schedules.
 5 c. Moisture Barrier for Indoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
 6 d. Moisture Barrier for Outdoor Applications: 2.5-mil- (0.063-mm-) thick polysurlyn.
 7 e. Factory-Fabricated Fitting Covers:
- 8 1) Same material, finish, and thickness as jacket.
 9 2) Field fabricate fitting covers only if factory-fabricated fitting covers are not
 10 available.

11 **2.5 SECUREMENTS**

- 12 A. Bands:
- 13 1. Products: Subject to compliance with requirements, provide one of the following:
- 14 a. ITW Insulation Systems; Gerrard Strapping and Seals.
 15 b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
- 16 2. Stainless Steel: ASTM A167 or ASTM A240/A240M, Type 304; 0.015 inch (0.38 mm)
 17 thick, 1/2 inch (13 mm) wide with wing seal.
- 18 B. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

19 **PART 3 - EXECUTION**

20 **3.1 EXAMINATION**

- 21 A. Examine substrates and conditions for compliance with requirements for installation tolerances
 22 and other conditions affecting performance of insulation application.
- 23 1. Verify that systems to be insulated have been tested and are free of defects.
 24 2. Verify that surfaces to be insulated are clean and dry.
- 25 B. Proceed with installation only after unsatisfactory conditions have been corrected.

26 **3.2 PREPARATION**

- 27 A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will
 28 adversely affect insulation application.

29 **3.3 GENERAL INSTALLATION REQUIREMENTS**

- 30 A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces;
 31 free of voids throughout the length of piping including fittings, valves, and specialties.

- 1 B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required
2 for each item of pipe system as specified in insulation system schedules.
- 3 C. Install accessories compatible with insulation materials and suitable for the service. Install
4 accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or
5 dry state.
- 6 D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- 7 E. Install multiple layers of insulation with longitudinal and end seams staggered.
- 8 F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- 9 G. Keep insulation materials dry during application and finishing.
- 10 H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with
11 adhesive recommended by insulation material manufacturer.
- 12 I. Install insulation with least number of joints practical.
- 13 J. Below Ambient Systems:
- 14 1. Provide continuous vapor barrier; seal joints, longitudinal seams, and penetrations in
15 insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic
16 and joint sealant.
- 17 2. Where mastic is indicated provide vapor-barrier mastic as required for indoor or outdoor
18 application.
- 19 3. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with
20 continuous vapor barrier and thermal integrity unless otherwise indicated.
- 21 4. Install insulation continuously through hangers and around anchor attachments.
- 22 5. Extend insulation on anchor legs from point of attachment to supported item to point of
23 attachment to structure. Taper and seal ends at attachment to structure with vapor-
24 barrier mastic.
- 25 K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet
26 and dry film thicknesses.
- 27 L. Install insulation with factory-applied jackets as follows:
- 28 1. Draw jacket tight and smooth.
- 29 2. Cover joints and seams with tape, according to insulation material manufacturer's written
30 instructions, to maintain vapor seal.
- 31 M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal
32 thickness.
- 33 N. Repair damaged insulation facings by applying same facing material over damaged areas.
34 Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal
35 patches similar to butt joints.

- 1 3. Fill voids between inner circumference of flange insulation and outer circumference of
- 2 adjacent straight pipe segments with cut sections of sheet insulation of same thickness
- 3 as pipe insulation.
- 4 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive
- 5 to eliminate openings in insulation that allow passage of air to surface being insulated.

- 6 C. Insulation Installation on Pipe Fittings and Elbows:

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

- 10 D. Insulation Installation on Valves and Pipe Specialties:

- 11 1. Install preformed valve covers manufactured of same material as pipe insulation when
- 12 available.
- 13 2. When preformed valve covers are not available, install cut sections of pipe and sheet
- 14 insulation to valve body. Arrange insulation to permit access to packing and to allow
- 15 valve operation without disturbing insulation.
- 16 3. Install insulation to flanges as specified for flange insulation application.
- 17 4. Secure insulation to valves and specialties and seal seams with manufacturer's
- 18 recommended adhesive to eliminate openings in insulation that allow passage of air to
- 19 surface being insulated.

20 **3.6 FIELD-APPLIED JACKET INSTALLATION**

- 21 A. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and
- 22 end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with
- 23 weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-
- 24 steel bands 12 inches (300 mm) o.c. and at end joints.

- 25 1. Do not install metal jacket over glass-cloth jacket.

26 **3.7 FINISHES**

- 27 A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of
- 28 insulation manufacturer's recommended protective coating. Color per schedule below.

- 29 B. Color: Final color as selected by Engineer. Vary first and second coats to allow visual inspection
- 30 of the completed Work.

- 31 1. White.

- 32 C. Do not field paint aluminum jackets.

33 **3.8 PIPING INSULATION SCHEDULE, GENERAL**

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

1 **3.9 INDOOR PIPING INSULATION SCHEDULE**

2 A. Stormwater and Overflow:

3 1. All Pipe Sizes: Insulation shall be the following:

4 a. Flexible Elastomeric: 1 inch (25 mm) thick.

5 B. Roof Drain and Overflow Drain Bodies:

6 1. All Pipe Sizes: Insulation shall be the following:

7 a. Flexible Elastomeric: 1 inch (25 mm) thick.

8 C. Floor Drains, Traps, and Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and
9 Equipment Drain Water below 60 Deg F (16 Deg C):

10 1. All Pipe Sizes: Insulation shall be the following:

11 a. Flexible Elastomeric: 1 inch (25 mm) thick.

12 **3.10 INDOOR, FIELD-APPLIED JACKET SCHEDULE**

13 A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-
14 applied jacket over the factory-applied jacket.

15 B. If more than one material is listed, selection from materials listed is Contractor's option.

16 C. Piping, Concealed:

17 1. None.

18 D. Piping, Exposed:

19 1. Aluminum, Corrugated: 0.016 inch (0.41 mm) thick.

20 **END OF SECTION 22 07 19.13**

1 **SECTION 22 07 19.15 - INSULATION FOR ADA PLUMBING FIXTURES**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section includes insulating the following plumbing piping services:
8 1. Supplies and drains for handicap-accessible lavatories and sinks.

9 **1.3 ACTION SUBMITTALS**

- 10 A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor
11 permeance thickness, and jackets (both factory- and field-applied, if any).

12 **1.4 QUALITY ASSURANCE**

- 13 A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship
14 program or another craft training program certified by the Department of Labor, Bureau of
15 Apprenticeship and Training.
- 16 B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing
17 identical products according to ASTM E84 by a testing agency acceptable to authorities having
18 jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and
19 cement material containers, with appropriate markings of applicable testing agency.
- 20 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed
21 index of 50 or less.
- 22 C. Comply with the following applicable standards and other requirements specified for
23 miscellaneous components:
- 24 1. Supply and Drain Protective Shielding Guards: ICC A117.1.

25 **1.5 DELIVERY, STORAGE, AND HANDLING**

- 26 A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate
27 ASTM standard designation, type and grade, and maximum use temperature.

1 **1.6 SCHEDULING**

2 A. Schedule insulation application after pressure testing systems and, where required, after
3 installing and testing heat tracing. Insulation application may begin on segments that have
4 satisfactory test results.

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

7 **PART 2 - PRODUCTS**

8 **2.1 INSULATION MATERIALS**

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

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

12 C. Products that come in contact with stainless steel shall have a leachable chloride content of less
13 than 50 ppm when tested according to ASTM C871.

14 D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable
15 according to ASTM C795.

16 **2.2 PROTECTIVE SHIELDING GUARDS**

17 A. Protective Shielding Pipe Covers,:

18 1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water
19 supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA)
20 requirements.

21 B. Protective Shielding Piping Enclosures,:

22 1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-
23 water supplies and trap and drain piping. Comply with ADA requirements.

24 **PART 3 - EXECUTION**

25 **3.1 EXAMINATION**

26 A. Examine substrates and conditions for compliance with requirements for installation tolerances
27 and other conditions affecting performance of insulation application.

28 1. Verify that systems to be insulated have been tested and are free of defects.
29 2. Verify that surfaces to be insulated are clean and dry.

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

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1 **3.2 PREPARATION**

2 A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will
3 adversely affect insulation application.

4 **3.3 GENERAL INSTALLATION REQUIREMENTS**

5 A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces;
6 free of voids throughout the length of piping including fittings, valves, and specialties.

7 B. Install accessories compatible with insulation materials and suitable for the service. Install
8 accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or
9 dry state.

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

11 D. Keep insulation materials dry during application and finishing.

12 E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with
13 adhesive recommended by insulation material manufacturer.

14 F. Install insulation with least number of joints practical.

15 G. Repair damaged insulation facings by applying same facing material over damaged areas.
16 Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal
17 patches similar to butt joints.

18 **3.4 PROTECTIVE SHIELDING PIPE COVERS INSTALLATION**

19 A. Install directly over bare piping or insulation with factory-applied jackets. Press seams together
20 to engage internal fasteners.

21 **3.5 PIPING INSULATION SCHEDULE, GENERAL**

22 A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for
23 each piping system and pipe size range.

24 **3.6 INDOOR PIPING INSULATION SCHEDULE**

25 A. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing
26 Fixtures for People with Disabilities:

27 1. All Pipe Sizes: Insulation shall be the following:

28 a. Manufactured Protective Shielding Pipe Covers.

29 **END OF SECTION 22 07 19.15**

1 **SECTION 22 11 16 - DOMESTIC WATER PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Copper tube and fittings.
9 2. Piping joining materials.
10 3. Encasement for piping.
11 4. Transition fittings.
12 5. Dielectric fittings.

13 **1.3 ACTION SUBMITTALS**

- 14 A. Product Data: For transition fittings and dielectric fittings.

15 **1.4 INFORMATIONAL SUBMITTALS**

- 16 A. System purging and disinfecting activities report.
17 B. Field quality-control reports.

18 **1.5 FIELD CONDITIONS**

- 19 A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by
20 Owner or others unless permitted under the following conditions and then only after arranging to
21 provide temporary water service according to requirements indicated:
22 1. Notify Owner no fewer than 5 days in advance of proposed interruption of water service.
23 2. Do not interrupt water service without Owner's written permission.

24 **PART 2 - PRODUCTS**

25 **2.1 PIPING MATERIALS**

- 26 A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting
27 materials, and joining methods for specific services, service locations, and pipe sizes.

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

3 **2.2 COPPER TUBE AND FITTINGS**

- 4 A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.

- 5 B. Soft Copper Tube: ASTM B 88, Type K (ASTM B 88M, Type A) water tube, annealed
6 temper. Fittings in "Cast-Copper, Solder-Joint Fittings" Paragraph below are available in
7 NPS 1/4 to NPS 12 (DN 8 to DN 300).

8

- 9 C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

- 10 D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

- 11 E. Copper Unions:

- 12 1. MSS SP-123.
13 2. Cast-copper-alloy, hexagonal-stock body.
14 3. Ball-and-socket, metal-to-metal seating surfaces.
15 4. Solder-joint or threaded ends.
16

17 **2.3 PIPING JOINING MATERIALS**

- 18 A. Pipe-Flange Gasket Materials:

- 19 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch (3.2 mm) thick or ASME B16.21,
20 nonmetallic and asbestos free unless otherwise indicated.
21 2. Full-face or ring type unless otherwise indicated.

- 22 B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

- 23 C. Solder Filler Metals: ASTM B 32, lead-free alloys.

- 24 D. Flux: ASTM B 813, water flushable.

- 25 E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to
26 ASTM F 656.

- 27 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated
28 according to 40 CFR 59, Subpart D (EPA Method 24).
29 2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according
30 to 40 CFR 59, Subpart D (EPA Method 24).
31 3. Solvent cement and adhesive primer shall comply with the testing and product
32 requirements of the California Department of Health Services' "Standard Practice for the
33 Testing of Volatile Organic Emissions from Various Sources Using Small-Scale
34 Environmental Chambers."

- 35 F. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping
36 system manufacturer unless otherwise indicated.

1 **2.4 ENCASEMENT FOR PIPING**

- 2 A. Standard: ASTM A 674 or AWWA C105/A21.5.
- 3 B. Form: Sheet or tube.
- 4 C. Color: Black.

5 **2.5 TRANSITION FITTINGS**

- 6 A. General Requirements:
 - 7 1. Same size as pipes to be joined.
 - 8 2. Pressure rating at least equal to pipes to be joined.
 - 9 3. End connections compatible with pipes to be joined.
- 10 B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- 11
- 12 C. Sleeve-Type Transition Coupling: AWWA C219.
- 13 D. Plastic-to-Metal Transition Fittings:
 - 14 1. Description:
 - 15 a. CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - 16 b. One end with threaded brass insert and one solvent-cement-socket or threaded end.
 - 17
- 18 E. Plastic-to-Metal Transition Unions:
 - 19 1. Description:
 - 20 a. CPVC four-part union.
 - 21 b. Brass or stainless-steel threaded end.
 - 22 c. Solvent-cement-joint or threaded plastic end.
 - 23 d. Rubber O-ring.
 - 24 e. Union nut.

25 **2.6 DIELECTRIC FITTINGS**

- 26 A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- 27
- 28 B. Dielectric Unions:
 - 29 1. Standard: ASSE 1079.
 - 30 2. Pressure Rating: .
 - 31 3. End Connections: Solder-joint copper alloy and threaded ferrous.
- 32 C. Dielectric Flanges:
 - 33 1. Standard: ASSE 1079.

- 1 2. Factory-fabricated, bolted, companion-flange assembly.
- 2 3. Pressure Rating: .
- 3 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint
- 4 copper alloy and threaded ferrous.

- 5 D. Dielectric-Flange Insulating Kits:

- 6 1. Nonconducting materials for field assembly of companion flanges.
- 7 2. Pressure Rating: 150 psig (1035 kPa).
- 8 3. Gasket: Neoprene or phenolic.
- 9 4. Bolt Sleeves: Phenolic or polyethylene.
- 10 5. Washers: Phenolic with steel backing washers.

11 **PART 3 - EXECUTION**

12 **3.1 EARTHWORK**

- 13 A. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and
- 14 backfilling.

15 **3.2 PIPING INSTALLATION**

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

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

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

- 23 D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve
- 24 inside the building at each domestic water-service entrance. Comply with requirements for
- 25 pressure gages in Section 22 05 19 "Meters and Gages for Plumbing Piping" and with
- 26 requirements for drain valves and strainers in Section 22 11 19 "Domestic Water Piping
- 27 Specialties."

- 28 E. Install shutoff valve immediately upstream of each dielectric fitting.

- 29 F. Install water-pressure-reducing valves downstream from shutoff valves if static service pressure
- 30 exceeds 60 psig. Comply with requirements for pressure-reducing valves in Section 22 11 19
- 31 "Domestic Water Piping Specialties."

- 32 G. Install domestic water piping level and plumb.

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

- 35 I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right
- 36 angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated
- 37 otherwise.

- 1 J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and
2 coordinate with other services occupying that space.
- 3 K. Install piping to permit valve servicing.
- 4 L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher
5 than the system pressure rating used in applications below unless otherwise indicated.
- 6 M. Install piping free of sags and bends.
- 7 N. Install fittings for changes in direction and branch connections.
- 8 O. Install unions in copper tubing at final connection to each piece of equipment, machine, and
9 specialty.
- 10 P. Install pressure gages on suction and discharge piping for each plumbing pump and packaged
11 booster pump. Comply with requirements for pressure gages in Section 22 05 19 "Meters and
12 Gages for Plumbing Piping."
- 13 Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in
14 Section 22 11 23 "Domestic Water Pumps."
- 15 R. Install thermometers on outlet piping from each water heater. Comply with requirements for
16 thermometers in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- 17 S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for
18 sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- 19 T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with
20 requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for
21 Plumbing Piping."
- 22 U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with
23 requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- 24 **3.3 JOINT CONSTRUCTION**
- 25 A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- 26 B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before
27 assembly.
- 28 C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut
29 threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore
30 full ID. Join pipe fittings and valves as follows:
- 31 1. Apply appropriate tape or thread compound to external pipe threads.
- 32 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or
33 damaged.
- 34 D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join
35 copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

- 1 E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and
 2 thickness suitable for domestic water service. Join flanges with gasket and bolts according to
 3 ASME B31.9.
- 4 F. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join
 5 pipe and fittings according to the following:
- 6 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent
 7 cements. Apply primer.
 8 2. PVC Piping: Join according to ASTM D 2855.
- 9 G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of
 10 both piping systems.

11 3.4 TRANSITION FITTING INSTALLATION

- 12 A. Install transition couplings at joints of dissimilar piping.
- 13 B. Transition Fittings in Underground Domestic Water Piping:
- 14 1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
 15 2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.
- 16 C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 (DN 50) and Smaller: Plastic-
 17 to-metal transition unions.

18 3.5 DIELECTRIC FITTING INSTALLATION

- 19 A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- 20 B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
- 21 C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flange kits.
- 22 D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

23 3.6 HANGER AND SUPPORT INSTALLATION

- 24 A. Comply with requirements for pipe hanger, support products, and installation in
 25 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- 26 1. Vertical Piping: MSS Type 8 clamps.
 27 2. Individual, Straight, Horizontal Piping Runs:
- 28 a. MSS Type 1, adjustable, steel clevis hangers.
- 29 3. Multiple, Straight, Horizontal Piping: MSS Type 44, pipe rolls. Support pipe rolls on
 30 trapeze.
- 31 B. Support vertical piping and tubing at base and at each floor.

- 1 C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch (10
- 2 mm).
- 3 D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum
- 4 rod diameters:
- 5 1. NPS 3/4 (DN 20) and Smaller: 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
- 6 2. NPS 1 and NPS 1-1/4 (DN 25 and DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm)
- 7 rod.
- 8 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm)
- 9 rod.
- 10 4. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
- 11 5. NPS 3 to NPS 5 (DN 80 to DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
- 12 6. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
- 13 7. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- 14 E. Install supports for vertical copper tubing every 10 feet (3 m).

15 3.7 CONNECTIONS

- 16 A. Drawings indicate general arrangement of piping, fittings, and specialties.
- 17 B. When installing piping adjacent to equipment and machines, allow space for service and
- 18 maintenance.
- 19 C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join
- 20 dissimilar piping materials.
- 21 D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to
- 22 the following:
- 23 1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not
- 24 smaller than sizes of water heater connections.
- 25 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller
- 26 than that required by plumbing code.
- 27 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than
- 28 equipment connections. Provide shutoff valve and union for each connection. Use
- 29 flanges instead of unions for NPS 2-1/2 (DN 65) and larger.

30 3.8 IDENTIFICATION

- 31 A. Identify system components. Comply with requirements for identification materials and
- 32 installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

33 3.9 FIELD QUALITY CONTROL

- 34 A. Perform the following tests and inspections:
- 35 1. Piping Inspections:
- 36 a. Do not enclose, cover, or put piping into operation until it has been inspected and
- 37 approved by authorities having jurisdiction.

- 1 b. During installation, notify authorities having jurisdiction at least one day before
 2 inspection must be made. Perform tests specified below in presence of authorities
 3 having jurisdiction:
- 4 1) Roughing-in Inspection: Arrange for inspection of piping before concealing
 5 or closing in after roughing in and before setting fixtures.
 6 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests
 7 specified in "Piping Tests" Subparagraph below and to ensure compliance
 8 with requirements.
- 9 c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or
 10 inspections, make required corrections and arrange for reinspection.
 11 d. Reports: Prepare inspection reports and have them signed by authorities having
 12 jurisdiction.
- 13 2. Piping Tests:
- 14 a. Fill domestic water piping. Check components to determine that they are not air
 15 bound and that piping is full of water.
 16 b. Test for leaks and defects in new piping and parts of existing piping that have been
 17 altered, extended, or repaired. If testing is performed in segments, submit a
 18 separate report for each test, complete with diagram of portion of piping tested.
 19 c. Leave new, altered, extended, or replaced domestic water piping uncovered and
 20 unconcealed until it has been tested and approved. Expose work that was covered
 21 or concealed before it was tested.
 22 d. Cap and subject piping to static water pressure of 50 psig (345 kPa) above
 23 operating pressure but not less than 150 psig (1034 kPa), without exceeding
 24 pressure rating of piping system materials. Isolate test source and allow it to stand
 25 for four hours. Leaks and loss in test pressure constitute defects that must be
 26 repaired.
 27 e. Repair leaks and defects with new materials, and retest piping or portion thereof
 28 until satisfactory results are obtained.
 29 f. Prepare reports for tests and for corrective action required.
- 30 B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- 31 C. Prepare test and inspection reports.

32 **3.10 ADJUSTING**

- 33 A. Perform the following adjustments before operation:
- 34 1. Close drain valves, hydrants, and hose bibbs.
 35 2. Open shutoff valves to fully open position.
 36 3. Open throttling valves to proper setting.
 37 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
- 38 a. Adjust calibrated balancing valves to flows indicated.
- 39 5. Remove plugs used during testing of piping and for temporary sealing of piping during
 40 installation.
 41 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 42 7. Check plumbing specialties and verify proper settings, adjustments, and operation.

1 **3.11 CLEANING**

- 2 A. Clean and disinfect potable domestic water piping as follows:
- 3 1. Purge new piping and parts of existing piping that have been altered, extended, or
4 repaired before using.
- 5 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if
6 methods are not prescribed, use procedures described in either AWWA C651 or
7 AWWA C652 or follow procedures described below:
- 8 a. Flush piping system with clean, potable water until dirty water does not appear at
9 outlets.
- 10 b. Fill and isolate system according to either of the following:
- 11 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm
12 (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
- 13 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm
14 (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
- 15 c. Flush system with clean, potable water until no chlorine is in water coming from
16 system after the standing time.
- 17 d. Repeat procedures if biological examination shows contamination.
- 18 e. Submit water samples in sterile bottles to authorities having jurisdiction.
- 19 B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-
20 sample approvals from authorities having jurisdiction.
- 21 C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

22 **3.12 PIPING SCHEDULE**

- 23 A. Transition and special fittings with pressure ratings at least equal to piping rating may be used
24 in applications below unless otherwise indicated.
- 25 B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- 26 C. Under-building-slab, domestic water piping, NPS 2 (DN 50) and smaller, shall be the following:
- 27 1. Soft copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-
28 joint fittings; and brazed joints.
- 29 D. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
- 30 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-
31 joint fittings; and soldered joints.
- 32 E. Aboveground domestic water piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100), shall be one of
33 the following:
- 34 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-
35 joint fittings; and soldered joints.
- 36 F. Aboveground domestic water piping, NPS 5 to NPS 8 (DN 125 to DN 200), shall be one of the
37 following:

- 1 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solder-
2 joint fittings; and soldered joints.

3 **3.13 VALVE SCHEDULE**

4 A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the
5 following requirements apply:

- 6 1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly, ball, or
7 gate valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
8 2. Throttling Duty: Use ball or globe valves for piping NPS 2 (DN 50) and smaller. Use
9 butterfly or ball valves with flanged ends for piping NPS 2-1/2 (DN 65) and larger.
10 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
11 4. Drain Duty: Hose-end drain valves.
- 12 B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- 13 C. Iron grooved-end valves may be used with grooved-end piping.

14 **END OF SECTION 22 11 16**

1 **SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Vacuum breakers.
9 2. Backflow preventers.
10 3. Water pressure-reducing valves.
11 4. Balancing valves.
12 5. Temperature-actuated, water mixing valves.
13 6. Strainers.
14 7. Hose stations.
15 8. Hose bibbs.
16 9. Wall hydrants.
17 10. Drain valves.
18 11. Water-hammer arresters.
19 12. Air vents.
20 13. Trap-seal primer valves.
21 14. Specialty valves.
22 15. Flexible connectors.
23 16. Water meters.

- 24 B. Related Requirements:

- 25 1. Section 22 05 19 "Meters and Gauges for Plumbing Piping" for thermometers, pressure
26 gages, and flow meters in domestic water piping.
27 2. Section 22 11 16 "Domestic Water Piping" for water meters.

28 **1.3 ACTION SUBMITTALS**

- 29 A. Product Data: For each type of product.

- 30 B. Shop Drawings: For domestic water piping specialties.

- 31 1. Include diagrams for power, signal, and control wiring.

32 **1.4 INFORMATIONAL SUBMITTALS**

- 33 A. Field quality-control reports.

1 **1.5 CLOSEOUT SUBMITTALS**

- 2 A. Operation and Maintenance Data: For domestic water piping specialties to include in
3 emergency, operation, and maintenance manuals.

4 **PART 2 - PRODUCTS**

5 **2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- 6 A. Potable-water piping and components shall comply with NSF 61.
7 B. Comply with NSF 372 for low lead.

8 **2.2 PERFORMANCE REQUIREMENTS**

- 9 A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 (860) psig (kPa) unless
10 otherwise indicated.

11 **2.3 VACUUM BREAKERS**

- 12 A. Hose-Connection Vacuum Breakers:

- 13 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; 8B or
14 comparable product by one of the following:

- 15 a. Conbraco Industries, Inc
16 b. Plumbing Products Group
17 c. Wilkins Water Control Products
18

- 19 2. Standard: ASSE 1011.
20 3. Body: Bronze, non-removable, with manual drain.
21 4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
22 5. Finish: Rough bronze.

- 23 B. Pressure Vacuum Breakers:

- 24 1. Basis-of-Design Product: Subject to compliance with requirements, provide Insert
25 manufacturer's Watts; LF800M4QT or comparable product by one of the following:

- 26 a. Conbraco Industries, Inc
27 b. Plumbing Products Group
28 c. Wilkins Water Control Products
29

- 30 2. Standard: ASSE 1020.
31 3. Operation: Continuous-pressure applications.
32 4. Pressure Loss: 5 (35) psig (kPa) maximum, through middle third of flow range.
33 5. Accessories:

- 34 a. Valves: Ball type, on inlet and outlet.

1 **2.4 BACKFLOW PREVENTERS**

2 A. Beverage-Dispensing-Equipment Backflow Preventers:

3 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; SD-3
4 or comparable product by one of the following:

- 5 a. Conbraco Industries, Inc
- 6 b. Zurn Industries, LLC
- 7 c. Plumbing Products Group
- 8 d. Wilkins Water Control Products

- 9 2. Standard: ASSE 1022.
- 10 3. Operation: Continuous-pressure applications.
- 11 4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).
- 12 5. Body: Stainless steel.
- 13 6. End Connections: Threaded.

14 B. Dual-Check-Valve Backflow Preventers:

15 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; LF7
16 or comparable product by one of the following:

- 17 a. Conbraco Industries, Inc
- 18 b. Zurn Industries, LLC
- 19 c. Plumbing Products Group
- 20 d. Wilkins Water Control Products

- 21 2. Standard: ASSE 1024.
- 22 3. Operation: Continuous-pressure applications.
- 23 4. Size: As required.
- 24 5. Body: Bronze, lead free, with union inlet.

25 C. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

26 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; SD-2
27 or comparable product by one of the following:

- 28 a. Cash Acme; a division of Reliance Worldwide Corporation
- 29 b. Lancer Corporation

- 30 2. Standard: ASSE 1032.
- 31 3. Operation: Continuous-pressure applications.
- 32 4. Size: NPS 1/4 or NPS 3/8 (DN 8 or DN 10).
- 33 5. Body: Stainless steel.
- 34 6. End Connections: Threaded.

35 D. Hose-Connection Backflow Preventers:

36 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts;
37 LFH7C or comparable product by one of the following:

- 38 a. Conbraco Industries, Inc.
- 39 b. Woodford Manufacturing Company; a division of WCM Industries, Inc

- 1 2. Standard: ASSE 1052.
- 2 3. Operation: Up to 10-foot head of water (30-kPa) back pressure.
- 3 4. Inlet Size: NPS 1/2 or NPS 3/4 (DN 15 or DN 20).
- 4 5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
- 5 6. Capacity: At least 3-gpm (0.19-L/s) flow.

- 6 E. Backflow-Preventer Test Kits:

- 7 1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-
- 8 procedure instructions.

9 **2.5 BALANCING VALVES**

- 10 A. Cast-Iron Calibrated Balancing Valves:

- 11 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; CSM-
- 12 81-F or comparable product by one of the following:

- 13 a. Armstrong International, Inc.
- 14 b. NIBCO Inc (F737).

- 15 2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting
- 16 indicator.
- 17 3. Size: Same as connected piping, but not smaller than NPS 2-1/2 (DN 65).

- 18 B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

- 19 C. Memory-Stop Balancing Valves:

- 20 1. Basis-of-Design Product: Subject to compliance with requirements, provide NIBCO Inc.;
- 21 T1710 or comparable product by one of the following:

- 22 a. Conbraco Industries, Inc.
- 23 b. Milwaukee Valve Company.

- 24 2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
- 25 3. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
- 26 4. Size: NPS 2 (DN 50) or smaller.
- 27 5. Body: Copper alloy.
- 28 6. Port: Standard or full port.
- 29 7. Ball: Chrome-plated brass.
- 30 8. Seats and Seals: Replaceable.
- 31 9. End Connections: Threaded.
- 32 10. Handle: Vinyl-covered steel with memory-setting device.

33 **2.6 TEMPERATURE-ACTUATED, WATER MIXING VALVES**

- 34 A. Individual Fixture, Water-Temperature Limiting Devices:

- 35 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts;
- 36 LFMMV or comparable product by one of the following:

- 37 a. Leonard Valve Company.

- 1 b. Powers; a division of Watts Water Technologies, Inc. (LFLM490)
- 2 c. Symmons Industries, Inc.

- 3 2. Standard: ASSE 1017, 1069, 1070
- 4 3. Pressure Rating: 125 psig (860 kPa).
- 5 4. Type: Thermostatically controlled, water mixing valve.
- 6 5. Material: Bronze body with corrosion-resistant interior components.
- 7 6. Connections: Threaded union inlets and outlet.
- 8 7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-
- 9 control handle.
- 10 8. Tempered-Water Setting: 120 deg F (49 deg C).
- 11
- 12 9. Valve Finish: Rough bronze.

- 13 B. Primary, Thermostatic, Water Mixing Valves:

- 14 1. Basis-of-Design Product: Subject to compliance with requirements, provide Lawler 66 or
- 15 800 Series (see drawing schedule) or comparable product by one of the following:

- 16 a. Powers.
- 17 b. Leonard Valve Company.
- 18 c. Symmons Industries, Inc.

- 19 2. Standard: ASSE 1017.
- 20 3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
- 21 4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
- 22 5. Material: Bronze, lead free, body with corrosion-resistant interior components.
- 23 6. Connections: Threaded union inlets and outlet.
- 24 7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies,
- 25 and adjustable, temperature-control handle.
- 26 8. Tempered-Water Setting: 120 deg F (49 deg C).
- 27 9. Pressure Drop at Design Flow Rate: 10 psig (kPa).
- 28 10. Valve Finish: Rough bronze.

29 **2.7 STRAINERS FOR DOMESTIC WATER PIPING**

- 30 A. Y-Pattern Strainers:

- 31 1. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated.
- 32 2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies
- 33 with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 (DN 65) and
- 34 larger.
- 35 3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2
- 36 (DN 65) and larger.
- 37 4. Screen: Stainless steel with round perforations unless otherwise indicated.
- 38 5. Perforation Size:

- 39 a. Strainers NPS 2 (DN 50) and Smaller: 0.020 (0.51) inch (mm).
- 40 b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 (1.14) inch (mm).
- 41 c. Strainers NPS 5 (DN 125) and Larger: 0.10 (2.54) inch (mm).

- 42 6. Drain: Factory-installed, hose-end drain valve.

1 **2.8 HOSE STATIONS**

2 A. Single-Temperature-Water Hose Stations:

3 A. Basis-of-Design Product: Subject to compliance with requirements, provide Leonard Valve
4 Company; THS-25-VBD-CW or comparable product by one of the following:

- 5 1. Armstrong International, Inc.
6 2. Leonard Valve Company.
7 3. T & S Brass.

8 B. Hot- and Cold-Water Hose Stations:

- 9 1. Standard: ASME A112.18.1.
10 2. Faucet Type: Thermostatic mixing valve.
11 3. Cabinet: Stainless-steel enclosure with exposed valve handles, hose connection, and
12 hose rack. Include thermometer in front.
13 4. Hose-Rack Material: Stainless steel.
14 5. Body Material: Bronze with stainless-steel wetted parts.
15 6. Body Finish: Chrome plated.
16 7. Mounting: Panel-type recessed stainless steel cabinet with No. 4 finish. Supply Fittings:
17 Two gate, globe, or ball valves and check valves and NPS 3/4 (DN 20) copper, water
18 tubing. Omit check valves if check stops are included with fitting.
19 8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 25 (7.6) feet
20 (m) long.
21 9. Nozzle: With hand-squeeze, on-off control.
22 10. Vacuum Breaker: Integral or factory-installed, non-removable, manual-drain-type, hose-
23 connection vacuum breaker complying with ASSE 1011 or backflow preventer complying
24 with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

25 **2.9 HOSE BIBBS**

26 A. Hose Bibbs:

- 27 1. Standard: ASME A112.18.1 for sediment faucets.
28 2. Body Material: Bronze.
29 3. Seat: Bronze, replaceable.
30 4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
31 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
32 6. Pressure Rating: 125 psig (860 kPa).
33 7. Vacuum Breaker: Integral non-removable, drainable, hose-connection vacuum breaker
34 complying with ASSE 1011.
35 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
36 9. Finish for Service Areas: Rough bronze.
37 10. Finish for Finished Rooms: Chrome or nickel plated.
38 11. Operation for Equipment Rooms: Wheel handle or operating key.
39 12. Operation for Service Areas: Wheel handle.
40 13. Operation for Finished Rooms: Operating key.
41 14. Include operating key with each operating-key hose bibb.
42 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

43 **2.10 DRAIN VALVES**

44 A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Plumbing Products SC-500A – SC2000F or comparable product by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. Precision Plumbing Products, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Watts Drainage Products.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 AIR VENTS

A. Welded-Construction Automatic Air Vents:

1. Body: Stainless steel.
2. Pressure Rating: 150-psig (1035-kPa) minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.13 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision Plumbing Products; P1-500 or comparable product by one of the following:
 - a. MIFAB, Inc.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

- 1 2. Standard: ASSE 1018.
- 2 3. Pressure Rating: 125 psig (860 kPa) minimum.
- 3 4. Body: Bronze.
- 4 5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
- 5 6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
- 6 7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome
- 7 finished.

8 **2.14 TRAP-SEAL PRIMER SYSTEMS**

- 9 A. Trap-Seal Primer Systems (Electronic Trap Primer):
- 10 1. Basis-of-Design Product: Subject to compliance with requirements, provide Precision
- 11 Plumbing Products; PT-1320 or PTS-1320 or comparable product by one of the following:
- 12
- 13 a. Sioux Chief Manufacturing Company, Inc.
- 14 b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- 15 c. Watts Drainage Products.
- 16
- 17 2. Standard: ASSE 1044.
- 18 3. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water
- 19 tubing.
- 20 4. Cabinet: Recessed or Surface-mounted steel box with stainless-steel cover.
- 21 5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
- 22 a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in
- 23 NFPA 70, by a qualified testing agency, and marked for intended location and
- 24 application.
- 25 6. Vacuum Breaker: ASSE 1001.
- 26 7. Number Outlets: 13 - 20
- 27 B. Size Outlets: NPS 1/2 (DN 15).

28 **2.15 FLEXIBLE CONNECTORS**

- 29 A. Basis-of-Design Product: Subject to compliance with requirements, provide Metraflex; BBS
- 30 (Bronze) or SST/MLP (Steel) or comparable product by one of the following:
- 31 1. Flex-Hose Co., Inc.
- 32 2. Flexicraft Industries.
- 33 B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering
- 34 and ends brazed to inner tubing.
- 35 1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
- 36 2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper
- 37 tube.
- 38 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.
- 39 C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel
- 40 wire-braid covering and ends welded to inner tubing.
- 41 1. Working-Pressure Rating: Minimum **[200 psig (1380 kPa)] [250 psig (1725 kPa)]**.
- 42 2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
- 43 3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

1 **PART 3 - EXECUTION**

2 **3.1 INSTALLATION**

3 A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment
 4 and systems and to other equipment and water systems that may be sources of contamination.
 5 Comply with authorities having jurisdiction.

- 6 1. Locate backflow preventers in same room as connected equipment or system.
- 7 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap
 8 fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe
 9 diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or
 10 under backflow preventer. Simple air breaks are unacceptable for this application.
- 11 3. Do not install bypass piping around backflow preventers.

12 B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop
 13 balancing valve. Install pressure gages on inlet and outlet.

14 C. Balancing Valves: Install in locations where they can easily be adjusted.

15 D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets
 16 and with shutoff valve on outlet.

- 17 1. Install cabinet-type units recessed in or surface mounted on wall as specified.

18 E. Y-Pattern Strainers: For water, install on supply side of each control valve, water pressure-
 19 reducing valve, solenoid valve, and pump.

20 F. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on
 21 outlet.

- 22 1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-
 23 by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement
 24 between studs. Comply with requirements for fire-retardant-treated-wood blocking in
 25 Section 06 10 00 "Rough Carpentry."

26 G. Ground Hydrants: Install with 1 (0.75) cu. yd. (cu. m) of crushed gravel around drain hole. Set
 27 ground hydrants with box flush with grade.

28 H. Non-freeze, Draining-Type Post Hydrants: Install with 1 (0.75) cu. yd. (cu. m) of crushed gravel
 29 around drain hole. Set post hydrants in concrete paving or in 1 (0.03) cu. ft. (cu. m) of concrete
 30 block at grade.

31 I. Water-Hammer Arresters: Install in water piping according to PDI-WH 201.

32 J. Air Vents: Install vents at high points of water piping. Install drain piping and discharge onto
 33 floor drain.

34 K. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap
 35 a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for
 36 proper flow.

1 **3.2 CONNECTIONS**

- 2 A. Drawings indicate general arrangement of piping, fittings, and specialties.
- 3 B. When installing piping specialties adjacent to equipment and machines, allow space for service
4 and maintenance.
- 5 C. Comply with requirements for grounding equipment in Section 26 05 26 "Grounding and
6 Bonding for Electrical Systems."

7 **3.3 IDENTIFICATION**

- 8 A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on
9 or near each of the following:
 - 10 1. Primary, thermostatic, water mixing valves.
 - 11 2. Manifold, thermostatic, water mixing-valve assemblies.
- 12 B. Distinguish among multiple units, inform operator of operational requirements, indicate safety
13 and emergency precautions, and warn of hazards and improper operations, in addition to
14 identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for
15 Plumbing Piping and Equipment."

16 **3.4 FIELD QUALITY CONTROL**

- 17 A. Perform the following tests and inspections:
 - 18 1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, and
19 double-check, backflow-prevention assembly according to authorities having jurisdiction
20 and the device's reference standard.
- 21 B. Domestic water piping specialties will be considered defective if they do not pass tests and
22 inspections.
- 23 C. Prepare test and inspection reports.

24 **3.5 ADJUSTING**

- 25 A. Set field-adjustable pressure set points of water pressure-reducing valves.
- 26 B. Set field-adjustable flow set points of balancing valves.
- 27 C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

28 **END OF SECTION 22 11 19**

1 **SECTION 22 11 23.21 - INLINE, DOMESTIC-WATER PUMPS**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
- 8 1. In-line, sealless centrifugal pumps.

- 9 B. Related Requirements:

10 **1.3 ACTION SUBMITTALS**

- 11 A. Product Data: For each type of product. Include construction materials, rated capacities,
12 certified performance curves with operating points plotted on curves, operating characteristics,
13 electrical characteristics, and furnished specialties and accessories.

14 **1.4 INFORMATIONAL SUBMITTALS**

- 15 A. Coordination Drawings: Detail pumps and adjacent equipment. Show support locations, type of
16 support, weight on each support, required clearances, and other details, drawn to scale, on
17 which the following items are shown and coordinated with each other, using input from installers
18 of the items involved:

- 19 1. Structural members to which pumps will be attached.
20 2. Size and location of initial access modules for acoustical tile.

- 21 B. Field quality-control reports.

22 **1.5 CLOSEOUT SUBMITTALS**

- 23 A. Operation and Maintenance Data: For inline, domestic-water pumps to include in operation and
24 maintenance manuals.

25 **1.6 DELIVERY, STORAGE, AND HANDLING**

- 26 A. Retain shipping flange protective covers and protective coatings during storage.

- 27 B. Protect bearings and couplings against damage.

- 28 C. Comply with pump manufacturer's written instructions for handling.

1 **PART 2 - PRODUCTS**

2 **2.1 PERFORMANCE REQUIREMENTS**

- 3 A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
- 4 by a qualified testing agency, and marked for intended location and application.
- 5 B. UL Compliance: UL 778 for motor-operated water pumps.
- 6 C. Drinking Water System Components - Health Effects and Drinking Water System Components -
- 7 Lead Content Compliance: NSF 61 and NSF 372.

8 **2.2 IN-LINE, SEALLESS CENTRIFUGAL PUMPS**

- 9 A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated
- 10 on Drawings or comparable product by one of the following:

- 11 1. Armstrong Pumps Inc.
- 12 2. Bell & Gossett Domestic Pump; ITT Corporation.
- 13 3. TACO Incorporated.

- 14 B. Pump Construction:

- 15 1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor
- 16 and impeller on common shaft and designed for installation with pump and motor shaft
- 17 horizontal.
- 18 2. Minimum Working Pressure: **125 psig (860 kPa)**.
- 19 3. Maximum Continuous Operating Temperature: **220 deg F (104 deg C)** .
- 20 4. Casing: Bronze, with threaded or companion-flange connections.
- 21 5. Impeller: Plastic.
- 22 6. Motor: Single speed.

23 **2.3 CONTROLS**

- 24 A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

- 25 1. Type: Water-immersion temperature sensor, for installation in piping.
- 26 2. Range: 65 to 200 deg F (18 to 93 deg C).
- 27 3. Enclosure: NEMA 250, Type 4X.
- 28 4. Operation of Pump: On or off.
- 29 5. Transformer: Provide if required.
- 30 6. Power Requirement: 120 V ac.
- 31 7. Settings: Start pump at 110 deg F (43 deg C) and stop pump at 120 deg F (49 deg C).

- 32 B. Timers: Electric, for control of hot-water circulation pump.

- 33 1. Type: Programmable, seven-day clock with manual override on-off switch.
- 34 2. Enclosure: NEMA 250, Type 1, suitable for wall mounting.
- 35 3. Operation of Pump: On or off.
- 36 4. Transformer: Provide if required.
- 37 5. Power Requirement: 120 V ac.
- 38 6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

1 **PART 3 - EXECUTION**

2 **3.1 EXAMINATION**

- 3 A. Examine roughing-in for domestic-water-piping system to verify actual locations of piping
4 connections before pump installation.

5 **3.2 PUMP INSTALLATION**

- 6 A. Comply with HI 1.4.
- 7 B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- 8 C. Mount pumps in orientation complying with manufacturer's written instructions.
- 9 D. Install thermostats in hot-water return piping.
- 10 E. Install timers adjacent to water heater.

11 **3.3 PIPING CONNECTIONS**

- 12 A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping."
13 Drawings indicate general arrangement of piping, fittings, and specialties.
- 14 B. Where installing piping adjacent to inline, domestic-water pumps, allow space for service and
15 maintenance.
- 16 C. Connect domestic-water piping to pumps. Install suction and discharge piping equal to or
17 greater than size of pump nozzles.
- 18 D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling
19 valves on discharge side of each pump. Install valves same size as connected piping. Comply
20 with requirements for strainers specified in Section 22 11 19 "Domestic Water Piping
21 Specialties." Comply with requirements for valves specified in the following:
- 22 1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
23 2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
24 3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
25 4. Install pressure gauge and snubber at suction of each pump and pressure gauge and
26 snubber at discharge of each pump. Install at integral pressure-gauge tapings where
27 provided or install pressure-gauge connectors in suction and discharge piping around
28 pumps. Comply with requirements for pressure gauges and snubbers specified in
29 Section 22 05 19 "Meters and Gages for Plumbing Piping."
- 30 E. Connect thermostats, and timers to pumps that they control.

31 **3.4 CONTROL CONNECTIONS**

- 32 A. Install control and electrical power wiring to field-mounted control devices.
- 33 B. Connect control wiring between temperature controllers and devices.

1 C. Interlock pump between water heater and hot-water storage tank with water heater burner and
 2 time-delay relay.

3 **3.5 IDENTIFICATION**

4 A. Identify system components. Comply with requirements for identification specified in
 5 Section 22 05 53 "Identification for Plumbing Piping and Equipment" for identification of pumps.

6 **3.6 FIELD QUALITY CONTROL**

7 A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

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

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

11 D. Perform tests and inspections.

12 E. Tests and Inspections:

- 13 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest
 14 until no leaks exist.
- 15 2. Operational Test: After electrical circuitry has been energized, start units to confirm
 16 proper motor rotation and unit operation.
- 17 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and
 18 equipment.

19 F. Inline, domestic-water pump will be considered defective if it does not pass tests and
 20 inspections.

21 G. Prepare test and inspection reports.

22 **3.7 STARTUP SERVICE**

23 A. Perform startup service.

- 24 1. Complete installation and startup checks according to manufacturer's written instructions.
- 25 2. Check piping connections for tightness.
- 26 3. Clean strainers on suction piping.
- 27 4. Set thermostats, and timers, for automatic starting and stopping operation of pumps.
- 28 5. Perform the following startup checks for each pump before starting:

- 29 a. Verify bearing lubrication.
- 30 b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is
 31 free to rotate with pump hot and cold. If pump is bound or drags, do not operate
 32 until cause of trouble is determined and corrected.
- 33 c. Verify that pump is rotating in the correct direction.

34 6. Prime pump by opening suction valves and closing drains, and prepare pump for
 35 operation.

36 7. Start motor.

- 1 8. Open discharge valve slowly.
- 2 9. Adjust temperature settings on thermostats.
- 3 10. Adjust timer settings.

4 **3.8 ADJUSTING**

- 5 A. Adjust inline, domestic-water pumps to function smoothly, and lubricate as recommended by
- 6 manufacturer.
- 7 B. Adjust initial temperature set points.
- 8 C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

9 **END OF SECTION 22 11 23.21**

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1 **SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Hub-and-spigot, cast-iron soil pipe and fittings.
9 2. Hubless, cast-iron soil pipe and fittings.
10 3. Galvanized-steel pipe and fittings.
11 4. Copper tube and fittings.
12 5. PVC pipe and fittings.
13 6. Specialty pipe fittings.
14 7. Encasement for underground metal piping.

- 15 B. Related Requirements:

- 16 1. Section 22 13 29 "Sanitary Sewerage Pumps" for effluent and sewage pumps.

17 **1.3 ACTION SUBMITTALS**

- 18 A. Product Data: For each type of product.

- 19 B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections,
20 and details.

21 **1.4 INFORMATIONAL SUBMITTALS**

- 22 A. Field quality-control reports.

23 **1.5 WARRANTY**

- 24 A. Listed manufacturers to provide labelling and warranty of their respective products.

25 **PART 2 - PRODUCTS**

26 **2.1 PERFORMANCE REQUIREMENTS**

- 27 A. Components and installation shall be capable of withstanding the following minimum working
28 pressure unless otherwise indicated:

1 1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

2 **2.2 PIPING MATERIALS**

3 A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

4 B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting
5 materials, and joining methods for specific services, service locations, and pipe sizes.

6 **2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

7 A. Pipe and Fittings: ASTM A888 or CISPI 301.

8 B. Single-Stack Aerator Fittings: ASME B16.45, hubless, cast-iron aerator and deaerator drainage
9 fittings.

10 C. Heavy-Duty, Hubless-Piping Couplings:

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

13 a. ANACO-Husky (SD 4000).

14 b. Clamp-All Corp (Hi-Torq 80).

15 c. MIFAB, Inc (MI-XHUB).

16 d. Mission Rubber Company; a division of MCP Industries, Inc (HeavyWeight).

17 2. Standards: ASTM C1277 and ASTM C1540.

18 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and
19 ASTM C564, rubber sleeve with integral, center pipe stop.

20 **2.4 GALVANIZED-STEEL PIPE AND FITTINGS**

21 A. Galvanized-Steel Pipe: ASTM A53/A53M, Type E, Standard Weight class. Include square-cut-
22 grooved or threaded ends matching joining method.

23 B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

24 C. Steel Pipe Pressure Fittings:

25 1. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or
26 ASTM A106/A106M, Schedule 40, seamless steel pipe. Include ends matching joining
27 method.

28 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-
29 socket, metal-to-metal, bronze seating surface; and female threaded ends.

30 3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

31 D. Cast-Iron Flanges: ASME B16.1, Class 125.

32 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-
33 inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

34 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

1 **2.5 DUCTILE-IRON PIPE AND FITTINGS**

2 A. Ductile-Iron, Push-on-Joint Piping:

- 3 1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends
 4 unless grooved or flanged ends are indicated.
 5 2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard
 6 pattern or AWWA C153/A21.53, ductile-iron compact pattern.
 7 3. Gaskets: AWWA C111/A21.11, rubber.

8 **2.6 COPPER TUBE AND FITTINGS**

9 A. Copper Type DWV Tube: ASTM B306, drainage tube, drawn temper.

10 B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-
 11 joint fittings.

12 C. Hard Copper Tube: ASTM B88, Type L and Type M (ASTM B88M, Type B and Type C), water
 13 tube, drawn temper.

14 D. Copper Pressure Fittings:

- 15 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper,
 16 solder-joint fittings. Furnish wrought-copper fittings if indicated.
 17 2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket,
 18 metal-to-metal seating surfaces, and solder-joint or threaded ends.

19 E. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

- 20 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-
 21 inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 22 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

23 F. Solder: ASTM B32, lead free with ASTM B813, water-flushable flux.

24 **2.7 PVC PIPE AND FITTINGS**

25 A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic
 26 piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping
 27 and "NSF-sewer" for plastic sewer piping.

28 B. Solid-Wall PVC Pipe: ASTM D2665, drain, waste, and vent.

29 C. PVC Socket Fittings: ASTM D2665, made to ASTM D3311, drain, waste, and vent patterns and
 30 to fit Schedule 40 pipe.

31 D. Adhesive Primer: ASTM F656.

32 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according
 33 to 40 CFR 59, Subpart D (EPA Method 24).

34 2. Adhesive primer shall comply with the testing and product requirements of the California
 35 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
 36 Emissions from Various Sources Using Small-Scale Environmental Chambers."

- 1 E. Solvent Cement: ASTM D2564.
- 2 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated
- 3 according to 40 CFR 59, Subpart D (EPA Method 24).
- 4 2. Solvent cement shall comply with the testing and product requirements of the California
- 5 Department of Health Services' "Standard Practice for the Testing of Volatile Organic
- 6 Emissions from Various Sources Using Small-Scale Environmental Chambers."

7 **2.8 SPECIALTY PIPE FITTINGS**

8 A. Transition Couplings:

- 9 1. General Requirements: Fitting or device for joining piping with small differences in OD's
- 10 or of different materials. Include end connections same size as and compatible with
- 11 pipes to be joined.
- 12 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping
- 13 system fitting.
- 14 3. Unshielded, Nonpressure Transition Couplings:
- 15 a. Standard: ASTM C1173.
- 16 b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear
- 17 ring and corrosion-resistant-metal tension band and tightening mechanism on each
- 18 end.
- 19 c. End Connections: Same size as and compatible with pipes to be joined.
- 20 d. Sleeve Materials:
- 21 1) For Cast-Iron Soil Pipes: ASTM C564, rubber.
- 22 2) For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
- 23 3) For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with
- 24 pipe materials being joined.
- 25 4. Pressure Transition Couplings:
- 26 a. Standard: AWWA C219.
- 27 b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to,
- 28 and ends compatible with, pipes to be joined.
- 29 c. Center-Sleeve Material: Manufacturer's standard.
- 30 d. Gasket Material: Natural or synthetic rubber.
- 31 e. Metal Component Finish: Corrosion-resistant coating or material.

32 B. Dielectric Fittings:

- 33 1. Dielectric Unions:
- 34 a. General Requirements: Assembly of copper alloy and ferrous materials with
- 35 separating nonconductive insulating material. Include end connections compatible
- 36 with pipes to be joined.
- 37 b. Description:
- 38 1) Standard: ASSE 1079.
- 39 2) Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
- 40 3) End Connections: Solder-joint copper alloy and threaded ferrous.

- 1 2. Dielectric-Flange Insulating Kits:
- 2 a. Description:
- 3 1) Nonconducting materials for field assembly of companion flanges.
- 4 2) Pressure Rating: 150 psig (1035 kPa).
- 5 3) Gasket: Neoprene or phenolic.
- 6 4) Bolt Sleeves: Phenolic or polyethylene.
- 7 5) Washers: Phenolic with steel backing washers.

8 **PART 3 - EXECUTION**

9 **3.1 EARTH MOVING**

- 10 A. Comply with requirements for excavating, trenching, and backfilling specified in
- 11 Section 31 20 00 "Earth Moving."

12 **3.2 PIPING INSTALLATION**

- 13 A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping
- 14 systems.
- 15 1. Indicated locations and arrangements were used to size pipe and calculate friction loss,
- 16 expansion, pump sizing, and other design considerations.
- 17 2. Install piping as indicated unless deviations to layout are approved on coordination
- 18 drawings.
- 19 B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms
- 20 and service areas.
- 21 C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right
- 22 angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated
- 23 otherwise.
- 24 D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 25 E. Install piping to permit valve servicing.
- 26 F. Install piping at indicated slopes.
- 27 G. Install piping free of sags and bends.
- 28 H. Install fittings for changes in direction and branch connections.
- 29 I. Install piping to allow application of insulation.
- 30 J. Make changes in direction for soil and waste drainage and vent piping using appropriate
- 31 branches, bends, and long-sweep bends.
- 32 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in
- 33 direction of flow is from horizontal to vertical.

- 1 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to
2 back or side by side with common drain pipe.
- 3 a. Straight tees, elbows, and crosses may be used on vent lines.
- 4 3. Do not change direction of flow more than 90 degrees.
- 5 4. Use proper size of standard increasers and reducers if pipes of different sizes are
6 connected.
- 7 a. Reducing size of waste piping in direction of flow is prohibited.
- 8 K. Lay buried building waste piping beginning at low point of each system.
- 9 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place
10 hub ends of piping upstream.
- 11 2. Install required gaskets according to manufacturer's written instructions for use of
12 lubricants, cements, and other installation requirements.
- 13 3. Maintain swab in piping and pull past each joint as completed.
- 14 L. Install soil and waste and vent piping at the following minimum slopes unless otherwise
15 indicated:
- 16 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3
17 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100)
18 and larger.
- 19 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
- 20 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- 21 M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook,"
22 Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- 23 1. Install encasement on underground piping according to ASTM A674 or
24 AWWA C105/A 21.5.
- 25 N. Install steel piping according to applicable plumbing code.
- 26 O. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- 27 P. Install aboveground PVC piping according to ASTM D2665.
- 28 Q. Install underground PVC piping according to ASTM D2321.
- 29 R. Install engineered soil and waste and vent piping systems as follows:
- 30 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
- 31 S. Install underground, ductile-iron, force-main piping according to AWWA C600.
- 32 1. Install buried piping inside building between wall and floor penetrations and connection to
33 sanitary sewer piping outside building with restrained joints.
- 34 2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- 35 T. Install force mains at elevations indicated.
- 36 U. Plumbing Specialties:

- 1 1. Install backwater valves in sanitary waster gravity-flow piping.
- 2 a. Comply with requirements for backwater valves specified in Section 22 13 19
- 3 "Sanitary Waste Piping Specialties."
- 4 2. Install cleanouts at grade and extend to where building sanitary drains connect to building
- 5 sanitary sewers in sanitary waste gravity-flow piping.
- 6 a. Install cleanout fitting with closure plug inside the building in sanitary drainage
- 7 force-main piping.
- 8 b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary
- 9 Waste Piping Specialties."
- 10 3. Install drains in sanitary waste gravity-flow piping.
- 11 a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste
- 12 Piping Specialties."
- 13 V. Do not enclose, cover, or put piping into operation until it is inspected and approved by
- 14 authorities having jurisdiction.
- 15 W. Install sleeves for piping penetrations of walls, ceilings, and floors.
- 16 1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve
- 17 Seals for Plumbing Piping."
- 18 X. Install sleeve seals for piping penetrations of concrete walls and slabs.
- 19 1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and
- 20 Sleeve Seals for Plumbing Piping."
- 21 Y. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- 22 1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons
- 23 for Plumbing Piping."
- 24 **3.3 JOINT CONSTRUCTION**
- 25 A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil
- 26 Pipe and Fittings Handbook" for compression joints.
- 27 B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and
- 28 Fittings Handbook" for hubless-piping coupling joints.
- 29 C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
- 30 1. Cut threads full and clean using sharp dies.
- 31 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and
- 32 valves as follows:
- 33 a. Apply appropriate tape or thread compound to external pipe threads unless dry
- 34 seal threading is specified.
- 35 b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded
- 36 or damaged.

- 1 c. Do not use pipe sections that have cracked or open welds.
- 2 D. Join copper tube and fittings with soldered joints according to ASTM B828. Use ASTM B813,
3 water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.
- 4 E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness.
5 Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in
6 cross pattern.
- 7 F. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe
8 and fittings according to the following:
 - 9 1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent
10 cements.
 - 11 2. ABS Piping: Join according to ASTM D2235 and ASTM D2661 appendixes.
 - 12 3. PVC Piping: Join according to ASTM D2855 and ASTM D2665 appendixes.

13 **3.4 SPECIALTY PIPE FITTING INSTALLATION**

- 14 A. Transition Couplings:
 - 15 1. Install transition couplings at joints of piping with small differences in ODs.
 - 16 2. In Waste Drainage Piping: Unshielded, nonpressure transition couplings.
 - 17 3. In Aboveground Force Main Piping: Fitting-type transition couplings.
 - 18 4. In Underground Force Main Piping:
 - 19 a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
 - 20 b. NPS 2 (DN 50) and Larger: Pressure transition couplings.
- 21 B. Dielectric Fittings:
 - 22 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - 23 2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
 - 24 3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flange kits.
 - 25 4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

26 **3.5 VALVE INSTALLATION**

- 27 A. Comply with requirements in Section 22 05 23.12 "Ball Valves for Plumbing Piping,"
28 Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," Section 22 05 23.14 "Check Valves
29 for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping" for general-
30 duty valve installation requirements.
- 31 B. Shutoff Valves:
 - 32 1. Install shutoff valve on each sewage pump discharge.
 - 33 2. Install gate or full-port ball valve for piping NPS 2 (DN 50) and smaller.
 - 34 3. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.
- 35 C. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage
36 pump discharge.
- 37 D. Backwater Valves: Install backwater valves in piping subject to backflow.

- 1 1. Horizontal Piping: Horizontal backwater valves.
- 2 2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
- 3 3. Install backwater valves in accessible locations.
- 4 4. Comply with requirements for backwater valve specified in Section 22 13 19 "Sanitary
- 5 Waste Piping Specialties."

6 3.6 HANGER AND SUPPORT INSTALLATION

- 7 A. Comply with requirements for pipe hanger and support devices and installation specified in
- 8 Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- 9 Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."
- 10 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
- 11 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
- 12 3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
- 13 4. Vertical Piping: MSS Type 8 or Type 42, clamps.
- 14 5. Install individual, straight, horizontal piping runs:
 - 15 a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
 - 16 b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
 - 17 c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.
- 18 6. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe
- 19 rolls. Support pipe rolls on trapeze.
- 20 7. Base of Vertical Piping: MSS Type 52, spring hangers.
- 21 B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and
- 22 coupling.
- 23 C. Support vertical piping and tubing at base and at each floor.
- 24 D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum
- 25 rods.
- 26 E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and
- 27 minimum rod diameters:
 - 28 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm)
 - 29 rod.
 - 30 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
 - 31 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm)
 - 32 rod.
 - 33 4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm)
 - 34 rod.
 - 35 5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm)
 - 36 rod.
 - 37 6. Spacing for 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings
 - 38 is limited to 60 inches (1500 mm).
- 39 F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
- 40 G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod
- 41 diameters:

- 1 1. NPS 1-1/4 (DN 32): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
 - 2 2. NPS 1-1/2 (DN 40): 108 inches (2700 mm) with 3/8-inch (10-mm) rod.
 - 3 3. NPS 2 (DN 50): 10 feet (3 m) with 3/8-inch (10-mm) rod.
 - 4 4. NPS 2-1/2 (DN 65): 11 feet (3.4 m) with 1/2-inch (13-mm) rod.
 - 5 5. NPS 3 (DN 80): 12 feet (3.7 m) with 1/2-inch (13-mm) rod.
 - 6 6. NPS 4 and NPS 5 (DN 100 and DN 125): 12 feet (3.7 m) with 5/8-inch (16-mm) rod.
 - 7 7. NPS 6 and NPS 8 (DN 150 and DN 200): 12 feet (3.7 m) with 3/4-inch (19-mm) rod.
 - 8 8. NPS 10 and NPS 12 (DN 250 and DN 300): 12 feet (3.7 m) with 7/8-inch (22-mm) rod.
- 9 H. Install supports for vertical steel piping every 15 feet (4.5 m).
- 10 I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum
11 rod diameters:
- 12 1. NPS 1-1/4 (DN 32): 72 inches (1800 mm) with 3/8-inch (10-mm) rod.
 - 13 2. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 96 inches (2400 mm) with 3/8-inch (10-mm)
14 rod.
 - 15 3. NPS 2-1/2 (DN 65): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
 - 16 4. NPS 3 and NPS 5 (DN 80 and DN 125): 10 feet (3 m) with 1/2-inch (13-mm) rod.
 - 17 5. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.
 - 18 6. NPS 8 (DN 200): 10 feet (3 m) with 3/4-inch (19-mm) rod.
- 19 J. Install supports for vertical copper tubing every 10 feet (3 m).
- 20 K. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written
21 instructions.

22 3.7 CONNECTIONS

- 23 A. Drawings indicate general arrangement of piping, fittings, and specialties.
- 24 B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join
25 dissimilar piping materials.
- 26 C. Connect waste and vent piping to the following:
- 27 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required
28 by plumbing code.
 - 29 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated,
30 but not smaller than required by authorities having jurisdiction.
 - 31 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller
32 than required by plumbing code.
 - 33 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover
34 flush with floor.
 - 35 5. Install horizontal backwater valves with cleanout cover flush with floor.
 - 36 6. Comply with requirements for backwater valves, cleanouts, and drains specified in
37 Section 22 13 19 "Sanitary Waste Piping Specialties."
 - 38 7. Equipment: Connect waste piping as indicated.
- 39 a. Provide shutoff valve if indicated and union for each connection.
 - 40 b. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.
- 41 D. Connect force-main piping to the following:

- 1 1. Sanitary Sewer: To exterior force main.
- 2 2. Sewage Pump: To sewage pump discharge.
- 3 E. Where installing piping adjacent to equipment, allow space for service and maintenance of
- 4 equipment.
- 5 F. Make connections according to the following unless otherwise indicated:
- 6 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final
- 7 connection to each piece of equipment.
- 8 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at
- 9 final connection to each piece of equipment.

10 3.8 IDENTIFICATION

- 11 A. Identify exposed sanitary waste and vent piping.
- 12 B. Comply with requirements for identification specified in Section 22 05 53 "Identification for
- 13 Plumbing Piping and Equipment."

14 3.9 FIELD QUALITY CONTROL

- 15 A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must
- 16 be made. Perform tests specified below in presence of authorities having jurisdiction.
- 17 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in
- 18 after roughing-in and before setting fixtures.
- 19 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe
- 20 tests specified below and to ensure compliance with requirements.
- 21 B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection,
- 22 make required corrections and arrange for reinspection.
- 23 C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- 24 D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or,
- 25 in absence of published procedures, as follows:
- 26 1. Test for leaks and defects in new piping and parts of existing piping that have been
- 27 altered, extended, or repaired.
- 28 a. If testing is performed in segments, submit separate report for each test, complete
- 29 with diagram of portion of piping tested.
- 30 2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent
- 31 piping until it has been tested and approved.
- 32 a. Expose work that was covered or concealed before it was tested.
- 33 3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside
- 34 leaders on completion of roughing-in.

- 1 a. Close openings in piping system and fill with water to point of overflow, but not less
- 2 than 10-foot head of water (30 kPa).
- 3 b. From 15 minutes before inspection starts to completion of inspection, water level
- 4 must not drop.
- 5 c. Inspect joints for leaks.

- 6 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled
- 7 with water, test connections and prove they are gastight and watertight.

- 8 a. Plug vent-stack openings on roof and building drains where they leave building.
- 9 Introduce air into piping system equal to pressure of 1-inch wg (250 Pa).
- 10 b. Use U-tube or manometer inserted in trap of water closet to measure this
- 11 pressure.
- 12 c. Air pressure must remain constant without introducing additional air throughout
- 13 period of inspection.
- 14 d. Inspect plumbing fixture connections for gas and water leaks.

- 15 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until
- 16 satisfactory results are obtained.
- 17 6. Prepare reports for tests and required corrective action.

- 18 E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence
- 19 of published procedures, as follows:

- 20 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping
- 21 until it has been tested and approved.

- 22 a. Expose work that was covered or concealed before it was tested.

- 23 2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating
- 24 pressure, without exceeding pressure rating of piping system materials.

- 25 a. Isolate test source and allow to stand for four hours.
- 26 b. Leaks and loss in test pressure constitute defects that must be repaired.

- 27 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until
- 28 satisfactory results are obtained.
- 29 4. Prepare reports for tests and required corrective action.

30 **3.10 CLEANING AND PROTECTION**

- 31 A. Clean interior of piping. Remove dirt and debris as work progresses.
- 32 B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging
- 33 with dirt and debris and to prevent damage from traffic and construction work.
- 34 C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- 35 D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based
- 36 latex paint.
- 37 E. Repair damage to adjacent materials caused by waste and vent piping installation.

- 1 **3.11 PIPING SCHEDULE**
- 2 A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- 3 B. Aboveground, soil, waste, and grease waste piping NPS 4 (DN 100) and smaller shall be any of
4 the following:
- 5 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and
6 coupled joints.
- 7 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- 8 C. Aboveground, soil, waste, and grease waste piping NPS 5 (DN 125) and larger shall be any of
9 the following:
- 10 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and
11 coupled joints.
- 12 D. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:
- 13 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and
14 coupled joints.
- 15 2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
- 16 a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2 (DN 65 and DN 90): Hard copper
17 tube, Type M (Type C); copper pressure fittings; and soldered joints.
- 18 E. Aboveground, vent piping NPS 5 (DN 125) and larger shall be any of the following:
- 19 1. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and
20 coupled joints.
- 21 F. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the
22 following:
- 23 1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
- 24 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- 25 G. Underground, soil and waste piping NPS 5 (DN 125) and larger Insert pipe size range shall
26 be any of the following:
- 27 1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
- 28 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- 29 H. Underground, grease waste piping NPS 4 (DN 100) and smaller shall be the following:
- 30 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
- 31 I. Underground, grease waste piping NPS 5 (DN 125) and larger Insert pipe size range shall be
32 the following:
- 33 1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
- 34 J. Aboveground sanitary-sewage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) shall
35 be any of the following:
- 36 1. Galvanized-steel pipe, pressure fittings, and threaded joints.
- 37 K. Aboveground sanitary-sewage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) shall be any
38 of the following:
- 39 1. Galvanized-steel pipe, pressure fittings, and threaded joints.
- 40 L. Underground sanitary-sewage force mains NPS 4 (DN 100) and smaller shall be any of the
41 following:

- 1 1. Ductile-iron, push-on-joint piping and push-on joints.
- 2 2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 (DN 40) and pressure
- 3 transition coupling for NPS 1-1/2 (DN 40) and larger if dissimilar pipe materials.

- 4 M. Underground sanitary-sewage force mains NPS 5 (DN 125) and larger shall be any of the
- 5 following:

- 6 1. Ductile-iron, push-on-joint piping and push-on joints.
- 7 2. Pressure transition couplings if dissimilar pipe materials.

- 8 **END OF SECTION 22 13 16**

1 **SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
- 8 1. Cleanouts.
 - 9 2. Floor drains.
 - 10 3. Floor sinks.
 - 11 4. Air-admittance valves.
 - 12 5. Roof flashing assemblies.
 - 13 6. Through-penetration firestop assemblies.
 - 14 7. Miscellaneous sanitary drainage piping specialties.
 - 15 8. Flashing materials.
- 16 B. Related Requirements:
- 17 1. Section 22 14 23 "Storm Drainage Piping Specialties" for storm drainage piping inside the
18 building, drainage piping specialties, and drains.

19 **1.3 DEFINITIONS**

- 20 A. ABS: Acrylonitrile-butadiene-styrene plastic.
- 21 B. FRP: Fiberglass-reinforced plastic.
- 22 C. HDPE: High-density polyethylene plastic.
- 23 D. PE: Polyethylene plastic.
- 24 E. PP: Polypropylene plastic.
- 25 F. PVC: Polyvinyl chloride plastic.

26 **1.4 ACTION SUBMITTALS**

- 27 A. Product Data: For each type of product indicated.
- 28 B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
- 29 1. Wiring Diagrams: Power, signal, and control wiring.

1 **1.5 INFORMATIONAL SUBMITTALS**

- 2 A. Field quality-control test reports.

3 **1.6 CLOSEOUT SUBMITTALS**

- 4 A. Operation and Maintenance Data: For drainage piping specialties to include in emergency,
5 operation, and maintenance manuals.

6 **1.7 QUALITY ASSURANCE**

- 7 A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing
8 agency.

- 9 B. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary
10 piping specialty components.

11 **1.8 COORDINATION**

- 12 A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete,
13 reinforcement, and formwork requirements are specified in Section 033053.1 "Miscellaneous
14 Cast-in-Place Concrete for Mechanical and Electrical Systems."

- 15 B. Coordinate size and location of roof penetrations.

16 **PART 2 - PRODUCTS**

17 **2.1 CLEANOUTS**

- 18 A. Exposed Metal Cleanouts:

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

- 21 a. Josam Company; Josam Div.
22 b. MIFAB, Inc.
23 c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
24 d. Watts Drainage Products Inc.

- 25 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
26 3. Size: Same as connected drainage piping
27 4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil
28 pipe test tee as required to match connected piping.
29 5. Closure: Countersunk , brass plug.
30 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
31 7. Closure: Stainless-steel plug with seal.

- 32 B. Metal Floor Cleanouts:

- 1 1. Basis-of-Design Product: Subject to compliance with requirements, products by one of
2 the following:
- 3 a. Josam Company; Josam Div.
4 b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
5 c. Watts Drainage Products Inc.
- 6 2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
7 3. Size: Same as connected branch.
8 4. Type: Threaded, adjustable housing.
9 5. Body or Ferrule: Cast iron.
10 6. Clamping Device: Required.
11 7. Outlet Connection: Inside calk.
12 8. Closure: Brass plug with tapered threads.
13 9. Adjustable Housing Material: Cast iron with threads.
14 10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
15 11. Frame and Cover Shape: Round.
16 12. Top Loading Classification: Medium Duty.
17 13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
- 18 C. Cast-Iron Wall Cleanouts:
- 19 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts CO-
20 460-RD or a comparable product by one of the following:
- 21 a. Josam Company; Josam Div.
22 b. MIFAB, Inc.
23 c. Smith, Jay R. Mfg. Co.; d of Smith Industries, Inc.
- 24 2. Standard: ASME A112.36.2M. Include wall access.
25 3. Size: Same as connected drainage piping.
26 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee
27 as required to match connected piping.
28 5. Closure: Countersunk , drilled-and-threaded brass plug.
29 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
30 7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

31 2.2 FLOOR DRAINS

- 32 A. Cast-Iron Floor Drains:
- 33 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts; FD-
34 100-A or a comparable product by one of the following:
- 35 a. Josam Company; Josam Div.
36 b. MIFAB, Inc.
37 c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- 38 2. Standard: ASME A112.6.3.
39 3. Pattern: Floor drain.
40 4. Body Material: Gray iron .
41 5. Seepage Flange: Required.
42 6. Anchor Flange: Required.
43 7. Clamping Device: Required.

- 1 8. Outlet: Bottom.
- 2 9. Top or Strainer Material: Nickel bronze.
- 3 10. Top Shape: Round; except square in tile floors.
- 4 11. Dimensions of Top or Strainer: 6-inch (152-mm).
- 5 12. Top Loading Classification: Medium Duty.
- 6 13. Funnel: Provide where indicated on plans.
- 7 14. Inlet Fitting: Gray iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
- 8
- 9 15. Trap Material: Cast iron.
- 10 16. Trap Pattern: Deep-seal P-trap.
- 11 17. Trap Features: Cleanout and trap-seal primer valve drain connection.

12 B. Floor Sinks:

- 13 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts FS-740 or a comparable product by one of the following:
- 14
- 15 a. Josam Company; Josam Div.
- 16 b. MIFAB, Inc.
- 17 c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- 18 2. Standard: ASME A112.6.3
- 19 3. Material: Cast iron
- 20 4. Coating: White, acid resistant porcelain enamel interior
- 21 5. Seepage Flange: Required.
- 22 6. Clamping Device: Required.
- 23 7. Outlet: Bottom.
- 24 8. Sediment Bucket: Not required.
- 25 9. Dome Strainer: Polypropylene
- 26 10. Grate Material: Coated cast iron
- 27 11. Grate pattern: half grate under equipment, whole grate in foot traffic.
- 28 12. Top Shape: Square.
- 29 13. Dimensions of Top or Strainer: 12-inch x 12-inch.
- 30 14. Depth: 8-inch
- 31 15. Trap Material: Cast iron.
- 32 16. Trap Pattern: Deep-seal P-trap.
- 33 17. Trap Features: Cleanout and trap-seal primer valve drain connection.

34 **2.3 AIR-ADMITTANCE VALVES**

35 A. Fixture Air-Admittance Valves :

- 36 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
- 37 following:
- 38 a. Oatey.
- 39 b. RectorSeal.
- 40 c. Studor, Inc.
- 41 2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
- 42 3. Housing: Plastic.
- 43 4. Operation: Mechanical sealing diaphragm.
- 44 5. Size: Same as connected fixture or branch vent piping.

- 1 B. Wall Box :
- 2 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
- 3 following:
- 4 a. Oatey.
- 5 b. RectorSeal.
- 6 c. Studor, Inc.
- 7 2. Description: White plastic housing with white plastic grille, made for recessed installation.
- 8 Include bottom pipe connection and space to contain one air-admittance valve.
- 9 3. Size: About 9 inches wide by 8 inches high by 4 inches deep (230 mm wide by 200 mm
- 10 high by 100 mm deep).

11 2.4 ROOF FLASHING ASSEMBLIES

- 12 A. Roof Flashing Assemblies :
- 13 1. Available Manufacturers: Subject to compliance with requirements, manufacturers
- 14 offering products that may be incorporated into the Work include, but are not limited to,
- 15 the following:
- 16 a. Acorn Engineering Company; Elmdor/Stoneman Div.
- 17 b. Thaler Metal Industries Ltd.
- 18 B. Description: Manufactured assembly made of 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch- (2.4-
- 19 mm-) thick, lead flashing collar and skirt extending at least 8 inches (200 mm) from pipe, with
- 20 galvanized-steel boot reinforcement and counterflashing fitting.
- 21 1. Open-Top Vent Cap: Without cap.

22 2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

- 23 A. Open Drains :
- 24 1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot,
- 25 cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where
- 26 required, increaser fitting joined with ASTM C 564, rubber gaskets.
- 27 2. Size: Same as connected waste piping.
- 28 B. Deep-Seal Traps :
- 29 1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping
- 30 and cleanout trap-seal primer valve connection.
- 31 2. Size: Same as connected waste piping.
- 32 a. NPS 2 (DN 50): 4-inch- (100-mm-) minimum water seal.
- 33 b. NPS 2-1/2 (DN 65) and Larger: 5-inch- (125-mm-) minimum water seal.
- 34 C. Floor-Drain, Trap-Seal Primer Fittings :
- 35 1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal
- 36 primer valve connection.

- 1 2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.
- 2 D. Air-Gap Fittings :
- 3 1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between
4 installed inlet and outlet piping.
- 5 2. Body: Bronze or cast iron.
- 6 3. Inlet: Opening in top of body.
- 7 4. Outlet: Larger than inlet.
- 8 5. Size: Same as connected waste piping and with inlet large enough for associated
9 indirect waste piping.
- 10 E. Sleeve Flashing Device :
- 11 1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for
12 pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top
13 of fitting that will extend 2 inches (51 mm) above finished floor and galvanized-steel pipe
14 extension in bottom of fitting that will extend through floor slab.
- 15 2. Size: As required for close fit to riser or stack piping.
- 16 F. Stack Flashing Fittings :
- 17 1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating
18 roof membrane, and with threaded or hub top for extending vent pipe.
- 19 2. Size: Same as connected stack vent or vent stack.

20 2.6 FLASHING MATERIALS

- 21 A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights
22 and thicknesses, unless otherwise indicated:
- 23 1. General Use: 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6-mm) thickness.
- 24 2. Vent Pipe Flashing: 3.0-lb/sq. ft. (15-kg/sq. m), 0.0469-inch (1.2-mm) thickness.
- 25 3. Burning: 6-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm) thickness.
- 26 B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil (1.01-mm)
27 minimum thickness.
- 28 C. Fasteners: Metal compatible with material and substrate being fastened.
- 29 D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units
30 required for installation; matching or compatible with material being installed.
- 31 E. Solder: ASTM B 32, lead-free alloy.
- 32 F. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

1 **PART 3 - EXECUTION**

2 **3.1 INSTALLATION**

3 A. Equipment Mounting: Install solids interceptors on cast-in-place concrete equipment base(s).
 4 Comply with requirements for equipment bases specified in Section 033053.1 "Miscellaneous
 5 Cast-in-Place Concrete for Mechanical and Electrical Systems."

- 6 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
- 7 2. Construct bases to withstand, without damage to equipment, seismic force required by
 8 code.
- 9 3. Construct concrete bases 4 inches (100 mm) high and extend base not less than 6
 10 inches (150 mm) in all directions beyond the maximum dimensions of solids
 11 interceptors, unless otherwise indicated or unless required for seismic anchor support.
- 12 4. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
- 13 5. Install dowel rods to connect concrete base to concrete floor. Unless otherwise
 14 indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of
 15 concrete base.
- 16 6. For supported equipment, install epoxy-coated anchor bolts that extend through concrete
 17 base, and anchor into structural concrete floor.
- 18 7. Place and secure anchorage devices. Use setting drawings, templates, diagrams,
 19 instructions, and directions furnished with items to be embedded.
- 20 8. Install anchor bolts to elevations required for proper attachment to supported equipment.

21 B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck
 22 plate flush with floor and centered over backwater valve cover, and of adequate size to remove
 23 valve cover for servicing.

24 C. Install cleanouts in aboveground piping and building drain piping according to the following,
 25 unless otherwise indicated:

- 26 1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger
 27 drainage piping unless larger cleanout is indicated.
- 28 2. Locate at each change in direction of piping greater than 45 degrees.
- 29 3. Locate at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and smaller and
 30 100 feet (30 m) for larger piping.
- 31 4. Locate at base of each vertical soil and waste stack.

32 D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with
 33 finished floor.

34 E. For cleanouts located in concealed piping, install cleanout wall access covers, of types
 35 indicated, with frame and cover flush with finished wall.

36 F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with
 37 finished floor, unless otherwise indicated.

- 38 1. Position floor drains for easy access and maintenance.
- 39 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set
 40 with grates depressed according to the following drainage area radii:

- 41 a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less
 42 than 1/4-inch (6.35-mm) total depression.
- 43 b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope.

- 1 c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not
2 greater than 1-inch (25-mm) total depression.
- 3 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and
4 adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
5 4. Install individual traps for floor drains connected to sanitary building drain, unless
6 otherwise indicated.
- 7 G. Install trench drains at low points of surface areas to be drained. Set grates of drains flush with
8 finished surface, unless otherwise indicated.
- 9 H. Assemble and install ASME A112.3.1, stainless-steel channel drainage systems according to
10 ASME A112.3.1. Install on support devices so that top will be flush with surface.
- 11 I. Assemble non-ASME A112.3.1, stainless-steel channel drainage system components according
12 to manufacturer's written instructions. Install on support devices so that top will be flush with
13 adjacent surface.
- 14 J. Assemble FRP channel drainage system components according to manufacturer's written
15 instructions. Install on support devices so that top will be flush with adjacent surface.
- 16 K. Assemble plastic channel drainage system components according to manufacturer's written
17 instructions. Install on support devices so that top will be flush with adjacent surface.
- 18 L. Install fixture air-admittance valves on fixture drain piping.
- 19 M. Install air-admittance-valve wall boxes recessed in wall.
- 20 N. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- 21 O. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- 22 P. Install through-penetration firestop assemblies in plastic stacks at floor penetrations.
- 23 Q. Assemble open drain fittings and install with top of hub 2 inches (51 mm) above floor.
- 24 R. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- 25 S. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer
26 connection.
- 27 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
28 2. Size: Same as floor drain inlet.
- 29 T. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping
30 discharge into sanitary drainage system.
- 31 U. Install sleeve flashing device with each riser and stack passing through floors with waterproof
32 membrane.
- 33 V. Install solids interceptors with cleanout immediately downstream from interceptors that do not
34 have integral cleanout on outlet. Install trap on interceptors that do not have integral trap and
35 are connected to sanitary drainage and vent systems.
- 36 W. Install wood-blocking reinforcement for wall-mounting-type specialties.

- 1 X. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is
2 indicated.

3 **3.2 CONNECTIONS**

- 4 A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping
5 installation requirements. Drawings indicate general arrangement of piping, fittings, and
6 specialties.

- 7 B. Install piping adjacent to equipment to allow service and maintenance.

8 **3.3 FLASHING INSTALLATION**

- 9 A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are
10 required. Join flashing according to the following if required:

- 11 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq. m), 0.0938-inch (2.4-mm)
12 thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch
13 (1.6-mm) thickness or thinner.
14 2. Copper Sheets: Solder joints of copper sheets.

- 15 B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors
16 and roofs with waterproof membrane.

- 17 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches (250
18 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
19 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm)
20 around sleeve.
21 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches
22 (200 mm) around specialty.

- 23 C. Set flashing on floors and roofs in solid coating of bituminous cement.

- 24 D. Secure flashing into sleeve and specialty clamping ring or device.

- 25 E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing
26 into cast-iron sleeve having calking recess.

- 27 F. Fabricate and install flashing and pans, sumps, and other drainage shapes.

28 **3.4 LABELING AND IDENTIFYING**

- 29 A. Distinguish among multiple units, inform operator of operational requirements, indicate safety
30 and emergency precautions, and warn of hazards and improper operations, in addition to
31 identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for
32 Plumbing Piping and Equipment."

33 **3.5 PROTECTION**

- 34 A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and
35 to prevent damage from traffic or construction work.

1 B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

2 **END OF SECTION 22 13 19**

1 **SECTION 22 13 23 - SANITARY WASTE INTERCEPTORS**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Grease interceptors.

9 **1.3 DEFINITIONS**

- 10 A. FRP: Fiberglass-reinforced plastic.

- 11 B. PP: Polypropylene.

12 **1.4 ACTION SUBMITTALS**

- 13 A. Product Data: For each type of metal and plastic interceptor. Include materials of fabrication,
14 dimensions, rated capacities, retention capacities, operating characteristics, size and location of
15 each pipe connection, furnished specialties, and accessories.

- 16 B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

- 17 1. Include materials of construction, dimensions, rated capacities, retention capacities,
18 location and size of each pipe connection, furnished specialties, and accessories.

19 **1.5 CLOSEOUT SUBMITTALS**

- 20 A. Operation and Maintenance Data: For sanitary waste interceptors to include in emergency,
21 operation, and maintenance manuals.

22 **1.6 FIELD CONDITIONS**

- 23 A. Interruption of Existing Sewer Services: Do not interrupt services to facilities occupied by Owner
24 or others unless permitted under the following conditions and then only after arranging to
25 provide temporary sewer services according to requirements indicated:

- 26 1. Notify Owner no fewer than seven days in advance of proposed interruption of service.
27 2. Do not proceed with interruption of sewer services without Owner's written permission.

1 **PART 2 - PRODUCTS**

2 **2.1 GREASE INTERCEPTORS**

3 A. Precast-Concrete Grease Interceptors: Comply with ASTM C913.

4 1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles,
5 and piping or openings to retain grease and to permit wastewater flow.

6 2. Structural Design Loads:

7 a. Heavy-Traffic Load: Comply with ASTM C890, A-16.

8 3. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into interceptor
9 walls, for each pipe connection.

10 4. Steps: Individual FRP steps, FRP ladder, or ASTM A615/A615M, deformed, 1/2-inch
11 (13-mm) steel reinforcing rods encased in ASTM D4101, PP, wide enough to allow
12 worker to place both feet on one step and designed to prevent lateral slippage off step.
13 Cast or anchor steps into sidewalls at 12- to 16-inch (300- to 400-mm) intervals. Omit
14 steps if total depth from floor of interceptor to finished grade is less than 60 inches (1500
15 mm).

16 5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch (150- to 225-mm) total thickness, to
17 match diameter of manhole frame and cover.

18 6. Manhole Frames and Covers: Ferrous; 24-inch (610-mm) ID by 7- to 9-inch (175- to 225-
19 mm) riser with 4-inch- (100-mm-) minimum-width flange and 26-inch- (660-mm-) diameter
20 cover.

21 a. Ductile Iron: ASTM A536, Grade 60-40-18, unless otherwise indicated.

22 b. Gray Iron: ASTM A48/A48M, Class 35, unless otherwise indicated.

23 c. Include indented top design with lettering cast into cover, using wording equivalent
24 to "GREASE INTERCEPTOR."

25 7. Capacities and Characteristics:

26 a. Number of Compartments: As indicated on Plans.

27 b. Retention Capacity: As indicated on Plans.

28 **PART 3 - EXECUTION**

29 **3.1 INSTALLATION**

30 A. Equipment Mounting:

31 1. Install solids interceptors on cast-in-place concrete equipment base(s).

32 2. Comply with requirements for equipment bases and foundations specified in Division 03.

33 B. Install precast concrete interceptors according to ASTM C891.

34 C. Set interceptors level and plumb.

35 D. Install manhole risers from top of underground concrete interceptors to manholes and gratings
36 at finished grade.

37 E. Set tops of manhole frames and covers flush with finished surface in pavements.

- 1 1. Set tops 3 inches (75 mm) above finish surface elsewhere unless otherwise indicated.
- 2 F. Set tops of grating frames and grates flush with finished surface.
- 3 G. Install grease interceptors, including trapping, venting, and flow-control fitting, according to
- 4 authorities having jurisdiction and with clear space for servicing.
- 5 1. Install cleanout immediately downstream from interceptors not having integral cleanout
- 6 on outlet.
- 7 H. Install oil interceptors, including trapping, venting, and flow-control fitting, according to

8 **3.2 PIPING CONNECTIONS**

- 9 A. Piping installation requirements are specified in Section 22 13 16 "Sanitary Waste and Vent
- 10 Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- 11 B. Make piping connections between interceptors and piping systems.

12 **3.3 IDENTIFICATION**

- 13 A. Identification materials and installation are specified in Division 31.
- 14 1. Arrange for installation of green warning tapes directly over piping and at outside edges
- 15 of underground interceptors.
- 16 2. Use warning tapes or detectable warning tape over ferrous piping.
- 17 3. Use detectable warning tape over nonferrous piping and over edges of underground
- 18 structures.
- 19 B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or
- 20 sign on or near each of the following:
- 21 1. Grease interceptors.

22 **3.4 PROTECTION**

- 23 A. Protect sanitary waste interceptors from damage during construction period.
- 24 B. Repair damage to adjacent materials caused by sanitary waste interceptor installation.

25 **END OF SECTION 22 13 23**

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1 **SECTION 22 14 13 - FACILITY STORM DRAINAGE PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
- 8 1. Hubless, cast-iron soil pipe and fittings.
 - 9 2. Galvanized-steel pipe and fittings.
 - 10 3. Ductile-iron pipe and fittings.
 - 11 4. PVC pipe and fittings.
 - 12 5. Specialty pipe and fittings.
- 13
- 14 B. Related Requirements:
- 15 1. Section 22 14 29 "Sump Pumps" for storm drainage pumps.
 - 16 2. Section 33 44 00 "Stormwater Utility Equipment" for storm drainage piping outside the
17 building.

18 **1.3 PERFORMANCE REQUIREMENTS**

- 19 A. Components and installation shall be capable of withstanding the following minimum working
20 pressure unless otherwise indicated:
- 21 1. Storm Drainage Piping: 10-foot head of water (30 kPa).
 - 22 2. Storm Drainage, Force-Main Piping: 100 psig (690 kPa).

23 **1.4 ACTION SUBMITTALS**

- 24 A. Product Data: For each type of product.

25 **1.5 INFORMATIONAL SUBMITTALS**

- 26 A. Field quality-control reports.

27 **1.6 QUALITY ASSURANCE**

- 28 A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- 1 B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for
 2 plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-
 3 sewer" for plastic sewer piping.

4 **1.7 FIELD CONDITIONS**

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

- 8 1. Notify Owner no fewer than 5 days in advance of proposed interruption of storm drainage
 9 service.
 10 2. Do not proceed with interruption of storm drainage service without Owner's written
 11 permission.

12 **PART 2 - PRODUCTS**

13 **2.1 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS**

- 14 A. Pipe and Fittings:

- 15 1. Marked with CISPI collective trademark and NSF certification mark.
 16 2. Standard: ASTM A 888 or CISPI 301.

- 17 B. Heavy-Duty, Hubless-Piping Couplings:

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

- 20 a. ANACO-Husky (SD 4000).
 21 b. Clamp-All Corp (Hi-Torq 80).
 22 c. MIFAB, Inc (MI-XHUB).
 23 d. Mission Rubber Company; a division of MCP Industries, Inc (HeavyWeight).

- 24 2. Standard: ASTM C 1540. **<Insert standard>**.
 25 3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and
 26 ASTM C 564, rubber sleeve with integral, center pipe stop.

27 **2.2 GALVANIZED-STEEL PIPE AND FITTINGS**

- 28 A. Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or
 29 threaded ends matching joining method.

- 30 B. Galvanized- Drainage Fittings: ASME B16.12, threaded.

- 31 C. Steel-Pipe Pressure Fittings:

- 32 1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or
 33 ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining
 34 method.

- 1 2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-
- 2 socket, metal-to-metal, bronze seating surface; and female threaded ends.
- 3 3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

4 **2.3 DUCTILE-IRON PIPE AND FITTINGS**

- 5 A. Ductile-Iron, Push-on-Joint Piping:
 - 6 1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end
 - 7 unless grooved or flanged ends are indicated.
 - 8 2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard
 - 9 pattern or AWWA C153/A21.53, ductile-iron compact pattern.
 - 10 3. Gaskets: AWWA C111/A21.11, rubber.

11 **2.4 PVC PIPE AND FITTINGS**

- 12 A. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related
- 13 Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm
- 14 drain and "NSF-sewer" for plastic storm sewer piping.
- 15 B. Solid-Wall PVC Pipe: ASTM D 2665; drain, waste, and vent.
- 16 C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns
- 17 and to fit Schedule 40 pipe.
- 18 D. Adhesive Primer: ASTM F 656.
- 19 E. Solvent Cement: ASTM D 2564.

20 **2.5 SPECIALTY PIPE FITTINGS**

- 21 A. Transition Couplings:
 - 22 1. General Requirements: Fitting or device for joining piping with small differences in ODs or
 - 23 of different materials. Include end connections same size as and compatible with pipes to
 - 24 be joined.
 - 25 2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-
 - 26 system fitting.
 - 27 3. Unshielded, Nonpressure Transition Couplings:
 - 28 a. Standard: ASTM C 1173.
 - 29 b. Description: Elastomeric sleeve, reducing or transition pattern. Include shear ring
 - 30 and corrosion-resistant-metal tension band and tightening mechanism on each
 - 31 end.
 - 32 c. Sleeve Materials:
 - 33 1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
 - 34 2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
 - 35 3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with
 - 36 pipe materials being joined.
 - 37 4. Pressure Transition Couplings:

- 1 a. Standard: AWWA C219.
- 2 b. Description: Metal, sleeve-type couplings same size as pipes to be joined, and with
- 3 pressure rating at least equal to and ends compatible with pipes to be joined.
- 4 c. Center-Sleeve Material: Manufacturer's standard.
- 5 d. Gasket Material: Natural or synthetic rubber.
- 6 e. Metal Component Finish: Corrosion-resistant coating or material.

7 B. Dielectric Fittings:

- 8 1. General Requirements: Assembly of copper alloy and ferrous materials with separating
- 9 nonconductive insulating material. Include end connections compatible with pipes to be
- 10 joined.
- 11 2. Dielectric Unions:
- 12 a. Description:
- 13 1) Standard: ASSE 1079.
- 14 2) Pressure Rating: 150 psig (1035 kPa) minimum at 180 deg F (82 deg C).
- 15 3) End Connections: Solder-joint copper alloy and threaded ferrous.
- 16 3. Dielectric-Flange Insulating Kits:
- 17 a. Description:
- 18 1) Nonconducting materials for field assembly of companion flanges.
- 19 2) Pressure Rating: 150 psig (1035 kPa).
- 20 3) Gasket: Neoprene or phenolic.
- 21 4) Bolt Sleeves: Phenolic or polyethylene.
- 22 5) Washers: Phenolic with steel-backing washers.

23 **PART 3 - EXECUTION**

24 **3.1 EARTH MOVING**

- 25 A. Comply with requirements for excavating, trenching, and backfilling specified in
- 26 Section 31 20 00 "Earth Moving."

27 **3.2 PIPING INSTALLATION**

- 28 A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping
- 29 systems.
- 30 1. Indicated locations and arrangements were used to size pipe and calculate friction loss,
- 31 expansion, pump sizing, and other design considerations.
- 32 2. Install piping as indicated unless deviations from layout are approved on coordination
- 33 drawings.
- 34 B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms
- 35 and service areas.
- 36 C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right
- 37 angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated
- 38 otherwise.

- 1 D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 2 E. Install piping to permit valve servicing.
- 3 F. Install piping at indicated slopes.
- 4 G. Install piping free of sags and bends.
- 5 H. Install fittings for changes in direction and branch connections.
- 6 I. Install piping to allow application of insulation.
- 7 J. Make changes in direction for piping using appropriate branches, bends, and long-sweep
8 bends.
- 9 1. Do not change direction of flow more than 90 degrees.
- 10 2. Use proper size of standard increasers and reducers if pipes of different sizes are
11 connected.
- 12 a. Reducing size of drainage piping in direction of flow is prohibited.
- 13 K. Lay buried building piping beginning at low point of each system.
- 14 1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place
15 hub ends of piping upstream.
- 16 2. Install required gaskets according to manufacturer's written instructions for use of
17 lubricants, cements, and other installation requirements.
- 18 3. Maintain swab in piping and pull past each joint as completed.
- 19 L. Install piping at the following minimum slopes unless otherwise indicated:
- 20 1. Building Storm Drain: 2 percent downward in direction of flow for piping NPS 3 (DN 80)
21 and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and
22 larger.
- 23 2. Horizontal Storm Drainage Piping: 2 percent downward in direction of flow.
- 24 M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook,"
25 Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- 26 N. Install steel piping according to applicable plumbing code.
- 27 O. Install aboveground PVC piping according to ASTM D 2665.
- 28 P. Install underground PVC piping according to ASTM D 2321.
- 29 Q. Install underground, ductile-iron, force-main piping according to AWWA C600.
- 30 1. Install buried piping inside building between wall and floor penetrations and connection to
31 storm sewer piping outside building with restrained joints.
- 32 2. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.
- 33 R. Install force mains at elevations indicated.
- 34 S. Plumbing Specialties:

- 1 1. Install backwater valves in storm drainage gravity-flow piping.
- 2 a. Comply with requirements for backwater valves specified in Section 22 14 23
- 3 "Storm Drainage Piping Specialties."
- 4 2. Install cleanouts at grade and extend to where building storm drains connect to building
- 5 storm sewers in storm drainage gravity-flow piping.
- 6 a. Install cleanout fitting with closure plug inside the building in storm drainage force-
- 7 main piping.
- 8 b. Comply with requirements for cleanouts specified in Section 22 14 23 "Storm
- 9 Drainage Piping Specialties."
- 10 3. Install drains in storm drainage gravity-flow piping.
- 11 a. Comply with requirements for drains specified in Section 22 14 23 "Storm Drainage
- 12 Piping Specialties."
- 13 T. Do not enclose, cover, or put piping into operation until it is inspected and approved by
- 14 authorities having jurisdiction.
- 15 U. Install sleeves for piping penetrations of walls, ceilings, and floors.
- 16 1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve
- 17 Seals for Plumbing Piping."
- 18 V. Install sleeve seals for piping penetrations of concrete walls and slabs.
- 19 1. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and
- 20 Sleeve Seals for Plumbing Piping."
- 21 W. Install escutcheons for piping penetrations of walls, ceilings, and floors.
- 22 1. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons
- 23 for Plumbing Piping."
- 24 **3.3 JOINT CONSTRUCTION**
- 25 A. Hubless, Cast-Iron Soil Piping Coupled Joints:
- 26 1. Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for
- 27 hubless-piping coupling joints.
- 28 B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
- 29 1. Cut threads full and clean using sharp dies.
- 30 2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and
- 31 valves as follows:
- 32 a. Apply appropriate tape or thread compound to external pipe threads unless dry
- 33 seal threading is specified.
- 34 b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded
- 35 or damaged.
- 36 c. Do not use pipe sections that have cracked or open welds.

- 1 C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness.
 2 Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in
 3 cross pattern.
- 4 D. Plastic, Non-pressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join
 5 pipe and fittings according to the following:
- 6 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent
 7 cements.
 8 2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendices.
- 9 E. Joint Restraints and Sway Bracing:
- 10 1. Provide joint restraints and sway bracing for storm drainage piping joints to comply with
 11 the following conditions:
- 12 a. Provide axial restraint for pipe and fittings 5 inches (125 mm) and larger, upstream
 13 and downstream of all changes in direction, branches, and changes in diameter
 14 greater than two pipe sizes.
 15 b. Provide rigid sway bracing for pipe and fittings 4 inches (100 mm) and larger,
 16 upstream and downstream of all changes in direction 45 degrees and greater.
 17 c. Provide rigid sway bracing for pipe and fittings 5 inches (125 mm) and larger,
 18 upstream and downstream of all changes in direction and branch openings.

19 3.4 SPECIALTY PIPE FITTING INSTALLATION

- 20 A. Transition Couplings:
- 21 1. Install transition couplings at joints of piping with small differences in ODs.
 22 2. In Drainage Piping: Unshielded, non-pressure transition couplings.
 23 3. In Aboveground Force-Main Piping: Fitting-type transition couplings.
 24 4. In Underground Force-Main Piping:
- 25 a. NPS 1-1/2 (DN 40) and Smaller: Fitting-type transition couplings.
 26 b. NPS 2 (DN 50) and Larger: Pressure transition couplings.
- 27 B. Dielectric Fittings:
- 28 1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 29 2. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
 30 3. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flange kits.
 31 4. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

32 3.5 VALVE INSTALLATION

- 33 A. General valve installation requirements for general-duty valve installations are specified in the
 34 following Sections:
- 35 1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."
 36 2. Section 22 05 23.13 "Butterfly Valves for Plumbing Piping."
 37 3. Section 22 05 23.14 "Check Valves for Plumbing Piping."
- 38 B. Shutoff Valves:

- 1 1. Install shutoff valve on each sump pump discharge.
- 2 2. Install full port ball valve for piping NS 2 (DN 50) and smaller.
- 3 3. Install gate valve for piping NPS 2-1/2 (DN 65) and larger.

- 4 C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump
- 5 discharge.

- 6 D. Backwater Valves: Install backwater valves in piping subject to backflow.

- 7 1. Horizontal Piping: Horizontal backwater valves.
- 8 2. Install backwater valves in accessible locations.
- 9 3. Comply with requirements for backwater valves specified in Section 22 14 23 "Storm
- 10 Drainage Piping Specialties."

- 11 **3.6 HANGER AND SUPPORT INSTALLATION**

- 12 A. Comply with requirements for pipe hanger and support devices and installation specified in
- 13 Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

- 14 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
- 15 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
- 16 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
- 17 4. Install individual, straight, horizontal piping runs:

- 18 a. MSS Type 1, adjustable, steel clevis hangers.

- 19 5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe
- 20 rolls. Support pipe rolls on trapeze.

- 21 B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve, and
- 22 coupling.

- 23 C. Support vertical piping and tubing at base and at each floor.

- 24 D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum
- 25 rods.

- 26 E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and
- 27 minimum rod diameters:

- 28 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm)
- 29 rod.
- 30 2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.
- 31 3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm)
- 32 rod.
- 33 4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm)
- 34 rod.
- 35 5. NPS 10 and NPS 12 (DN 250 and DN 300): 60 inches (1500 mm) with 7/8-inch (22-mm)
- 36 rod.
- 37 6. Spacing for 10-foot (3-m) pipe lengths may be increased to 10 feet (3 m). Spacing for
- 38 fittings is limited to 60 inches (1500 mm).

- 39 F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

1 **3.7 CONNECTIONS**

- 2 A. Drawings indicate general arrangement of piping, fittings, and specialties.
- 3 B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to
4 join dissimilar piping materials.
- 5 C. Connect storm drainage piping to roof drains and storm drainage specialties.
 - 6 1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover
7 flush with floor.
 - 8 2. Install horizontal backwater valves with cleanout cover flush with floor.
 - 9 3. Comply with requirements for backwater valves, cleanouts, and drains specified in
10 Section 22 14 23 "Storm Drainage Piping Specialties."
- 11 D. Connect force-main piping to the following:
 - 12 1. Storm Sewer: To exterior force main.
 - 13 2. Sump Pumps: To sump pump discharge.
- 14 E. Where installing piping adjacent to equipment, allow space for service and maintenance.
- 15 F. Make connections according to the following unless otherwise indicated:
 - 16 1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final
17 connection to each piece of equipment.
 - 18 2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at
19 final connection to each piece of equipment.

20 **3.8 IDENTIFICATION**

- 21 A. Identify exposed storm drainage piping.
- 22 B. Comply with requirements for identification specified in Section 22 05 53 "Identification for
23 Plumbing Piping and Equipment."

24 **3.9 FIELD QUALITY CONTROL**

- 25 A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must
26 be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 27 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in
28 after roughing-in.
 - 29 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe
30 tests specified below and to ensure compliance with requirements.
- 31 B. Test storm drainage piping according to procedures of authorities having jurisdiction or, in
32 absence of published procedures, as follows:
 - 33 1. Test for leaks and defects in new piping and parts of existing piping that have been
34 altered, extended, or repaired.

- 1 a. If testing is performed in segments, submit separate report for each test, complete
2 with diagram of portion of piping tested.
- 3 2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage
4 piping until it has been tested and approved.
- 5 a. Expose work that was covered or concealed before it was tested.
- 6 3. Test Procedure:
- 7 a. Test storm drainage piping on completion of roughing-in.
- 8 b. Close openings in piping system and fill with water to point of overflow, but not less
9 than 10-foot head of water (30 kPa). From 15 minutes before inspection starts until
10 completion of inspection, water level must not drop. Inspect joints for leaks.
- 11 4. Repair leaks and defects with new materials and retest piping, or portion thereof, until
12 satisfactory results are obtained.
- 13 5. Prepare reports for tests and required corrective action.
- 14 C. Test force-main piping according to procedures of authorities having jurisdiction or, in absence
15 of published procedures, as follows:
- 16 1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping
17 until it has been tested and approved.
- 18 a. Expose work that was covered or concealed before it was tested.
- 19 2. Cap and subject piping to static-water pressure of 50 psig (345 kPa) above operating
20 pressure, without exceeding pressure rating of piping system materials.
- 21 a. Isolate test source and allow to stand for four hours. Leaks and loss in test
22 pressure constitute defects that must be repaired.
- 23 3. Repair leaks and defects with new materials and retest piping, or portion thereof, until
24 satisfactory results are obtained.
- 25 4. Prepare reports for tests and required corrective action.
- 26 D. Piping will be considered defective if it does not pass tests and inspections.
- 27 E. Prepare test and inspection reports.

28 3.10 CLEANING AND PROTECTION

- 29 A. Clean interior of piping. Remove dirt and debris as work progresses.
- 30 B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and
31 to prevent damage from traffic and construction work.
- 32 C. Place plugs in ends of uncompleted piping at end of day and when work stops.

33 3.11 PIPING SCHEDULE

- 34 A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

- 1 B. Aboveground storm drainage piping NPS 6 (DN 150) and smaller shall be any of the following:
 - 2 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and
 - 3 coupled joints.
 - 4 2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- 5 C. Aboveground, storm drainage piping NPS 8 (DN 200) and larger shall be any of the following:
 - 6 1. Hubless, cast-iron soil pipe and fittings; heavy-duty, hubless-piping couplings; and
 - 7 coupled joints.
 - 8 2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- 9 D. Underground storm drainage piping NPS 6 (DN 150) and smaller shall be the following:
 - 10 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 11 2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- 12 E. Underground, storm drainage piping NPS 8 (DN 200) and larger shall be the following:
 - 13 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 14 2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.
- 15 F. Aboveground storm drainage force mains NPS 1-1/2 and NPS 2 (DN 40 and DN 50) shall be
 - 16 the following:
 - 17 1. Galvanized-steel pipe, pressure fittings, and threaded joints.
- 18 G. Aboveground storm drainage force mains NPS 2-1/2 to NPS 6 (DN 65 to DN 150) shall be the
 - 19 following:
 - 20 1. Galvanized-steel pipe, pressure fittings, and threaded joints.
 - 21 2. Fitting-type transition couplings if dissimilar pipe materials.
- 22 H. Underground storm drainage force mains NPS 4 (DN 100) and smaller shall be the following:
 - 23 1. Ductile-iron, push-on-joint piping and push-on joints.
 - 24 2. Fitting-type transition coupling for piping smaller than NPS 1-1/2 (DN 40) and pressure
 - 25 transition coupling for NPS 1-1/2 (DN 40) and larger if dissimilar pipe materials.
- 26 I. Underground storm drainage force mains NPS 5 (DN 125) and larger shall be the following:
 - 27 1. Ductile-iron, push-on-joint piping and push-on joints.
 - 28 2. Pressure transition couplings if dissimilar pipe materials.

29 **END OF SECTION 22 14 13**

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1 **SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8
9 1. Cleanouts.
10 2. Backwater valves.
11 3. Flashing materials.

12 **1.3 ACTION SUBMITTALS**

- 13 A. Product Data: For each type of product.

14 **1.4 QUALITY ASSURANCE**

- 15 A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing
16 agency.

17 **PART 2 - PRODUCTS**

18 **2.1 CLEANOUTS**

- 19 A. Cast-Iron Exposed Cleanouts
20 1. Standard: ASME A112.36.2M.
21 2. Size: Same as connected branch.
22 3. Body Material: No-hub, cast-iron soil pipe test tee as required to match connected
23 piping.
24 4. Closure: Countersunk or raised-head, brass plug.
25 5. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.
- 26 B. Cast-Iron Exposed Floor Cleanouts
27 1. Standard: ASME A112.36.2M.
28 2. Size: Same as connected branch.
29 3. Type: Threaded, adjustable housing.
30 4. Body or Ferrule: Cast iron.
31 5. Clamping Device: Not required.
32 6. Outlet Connection: No hub.
33 7. Closure: Brass plug with tapered threads.

- 1 8. Adjustable Housing Material: Cast iron with threads.
- 2 9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
- 3 10. Frame and Cover Shape: Round.
- 4 11. Top Loading Classification: Heavy Duty.
- 5 12. Riser: ASTM A 74, Serviceclass, cast-iron drainage pipe fitting and riser to clean out.

6 C. Cast-Iron Wall Cleanouts :

- 7 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts CO-
- 8 460-RD or comparable product by one of the following:
 - 9 a. Josam Company.
 - 10 b. MIFAB, Inc.
 - 11 c. Smith, Jay R. Mfg. Co.
- 12 2. Standard: ASME A112.36.2M. Include wall access.
- 13 3. Size: Same as connected drainage piping.
- 14 4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or No-hub, cast-iron soil pipe test tee
- 15 as required to match connected piping.
- 16 5. Closure Plug:
 - 17 a. Brass.
 - 18 b. Countersunk head.
 - 19 c. Drilled and threaded for cover attachment screw.
 - 20 d. Size: Same as, or not more than, one size smaller than cleanout size.
- 21 6. Wall Access: Round, deep, chrome-plated bronze cover plate with screw.
- 22 7. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame
- 23 and cover.

24 D. Exposed Metal Cleanouts and Test Tees:

- 25 1. Basis-of-Design Product: Subject to compliance with requirements, provide Watts CO-
- 26 460 or comparable product by one of the following:
 - 27 a. Josam Company.
 - 28 b. MIFAB, Inc.
 - 29 c. Smith, Jay R. Mfg. Co.
- 30 2. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301.
- 31 3. Size: Same as connected drainage piping.
- 32 4. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe
- 33 test tee as required to match connected piping.
- 34 5. Closure Plug: Countersunk,.

35 **PART 3 - EXECUTION**

36 **3.1 INSTALLATION**

- 37 A. Install cleanouts in aboveground piping and building drain piping according to the following
- 38 instructions unless otherwise indicated:
 - 39 1. Use cleanouts the same size as drainage piping up to NPS 4 (DN 100). Use NPS 4
 - 40 (DN 100) for larger drainage piping unless larger cleanout is indicated.

- 1 2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
- 2 3. Locate cleanouts at minimum intervals of 50 feet (15 m) for piping NPS 4 (DN 100) and
- 3 smaller and 100 feet (30 m) for larger piping.
- 4 4. Locate cleanouts at base of each vertical storm piping conductor.

- 5 B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with
- 6 finished floor.

- 7 C. For cleanouts located in concealed piping, install cleanout wall access covers, of types
- 8 indicated, with frame and cover flush with finished wall.

- 9 D. Install test tees in vertical conductors and near floor.

- 10 E. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

- 11 F. Install through-penetration firestop assemblies for penetrations of fire- and smoke-rated
- 12 assemblies.

- 13 1. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

14 **3.2 CONNECTIONS**

- 15 A. Comply with requirements for piping specified in Section 22 14 13 "Facility Storm Drainage
- 16 Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

- 17 B. Oil Interceptors: Connect inlet, outlet, vent, and gravity draw off piping to unit; flow-control fitting
- 18 and vent to unit inlet piping; and gravity draw off and suction piping to oil storage tank.

19 **3.3 PROTECTION**

- 20 A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and
- 21 to prevent damage from traffic or construction work.

- 22 B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

23 **END OF SECTION 22 14 23**

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1 **SECTION 22 14 29 - SUMP PUMPS**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
- 8 1. Packaged drainage-pump units.

9 **1.3 ACTION SUBMITTALS**

- 10 A. Product Data: For each type of product indicated. Include rated capacities, operating
11 characteristics, electrical characteristics, and furnished specialties and accessories.
- 12 B. Shop Drawings:
- 13 1. Include plans, elevations, sections, and mounting details.
14 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required
15 clearances, method of field assembly, components, and location and size of each field
16 connection.
17 3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments
18 to structure and to supported equipment. Include adjustable motor bases, rails, and
19 frames for equipment mounting.
20 4. Include diagrams for power, signal, and control wiring.

21 **1.4 CLOSEOUT SUBMITTALS**

- 22 A. Operation and Maintenance Data: For pumps and controls, to include in operation and
23 maintenance manuals.

24 **1.5 QUALITY ASSURANCE**

- 25 A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
26 by a qualified testing agency, and marked for intended location and application.
- 27 B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

28 **1.6 DELIVERY, STORAGE, AND HANDLING**

- 29 A. Retain shipping flange protective covers and protective coatings during storage.

- 1 B. Protect bearings and couplings against damage.
- 2 C. Comply with manufacturer's written instructions for handling.

3 **PART 2 - PRODUCTS**

4 **2.1 PERFORMANCE REQUIREMENTS**

- 5 A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
6 by a qualified testing agency, and marked for intended location and application.
- 7 B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

8 **2.2 PACKAGED DRAINAGE-PUMP UNITS**

- 9 A. Packaged Pedestal Drainage-Pump Units:

- 10 1. Description: Factory-assembled and -tested, automatic-operation, freestanding, sump-
11 pump unit.
- 12 2. Basis-of-Design Product: Subject to compliance with requirements, provide Little Giant
13 Pump Co.; 10EN-CIA-RFS or comparable product by one of the following:
 - 14 a. Pentair Pump Group; Hydromatic Pumps.
 - 15 b. Zoeller Company.
- 16 3. Pump Type: Wet-pit-volute, single-stage, separately coupled, overhung-impeller
17 centrifugal pump as defined in HI 1.1-1.2 and HI 1.3.
- 18 4. Pump Casing: Corrosion-resistant material, with strainer inlet, design that permits flow
19 into impeller, and vertical discharge for piping connection.
- 20 5. Impeller: Aluminum, brass, or plastic.
- 21 6. Motor: With built-in overload protection and mounted vertically on sump pump column.
- 22 7. Power Cord: Three-conductor, waterproof cable of length required, but not less than 72
23 inches (1830 mm), with grounding plug and cable-sealing assembly for connection at
24 pump.
- 25 8. Control: Float switch.

26 **2.3 MOTORS**

- 27 A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and
28 efficiency requirements for motors specified in Section 22 05 13 "Common Motor Requirements
29 for Plumbing Equipment."
 - 30 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will
31 not require motor to operate in service factor range above 1.0.
- 32 B. Motors for submersible pumps shall be hermetically sealed.

1 **PART 3 - EXECUTION**

2 **3.1 EXAMINATION**

- 3 A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping
4 connections before sump pump installation.

5 **3.2 INSTALLATION**

- 6 A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

7 **3.3 CONNECTIONS**

- 8 A. Where installing piping adjacent to equipment, allow space for service and maintenance.

9 **3.4 FIELD QUALITY CONTROL**

- 10 A. Manufacturer's Field Service: Engage a factory-authorized service representative to test,
11 inspect, and adjust components, assemblies, and equipment installations, including
12 connections.
- 13 B. Perform the following tests and inspections:
- 14 1. Perform each visual and mechanical inspection.
 - 15 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest
16 until no leaks exist.
 - 17 3. Operational Test: After electrical circuitry has been energized, start units to confirm
18 proper motor rotation and unit operation.
 - 19 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and
20 equipment.
- 21 C. Pumps and controls will be considered defective if they do not pass tests and inspections.
- 22 D. Prepare test and inspection reports.

23 **3.5 STARTUP SERVICE**

- 24 A. Perform startup service.
- 25 1. Complete installation and startup checks according to manufacturer's written instructions.

26 **3.6 ADJUSTING**

- 27 A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.
- 28 B. Adjust control set points.

1 **3.7 DEMONSTRATION**

2 A. Train Owner's maintenance personnel to adjust, operate, and maintain pumps.

3 **END OF SECTION 22 14 29**

1 **SECTION 22 16 23 FACILITY NATURAL-GAS PIPING**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Pipes, tubes, and fittings.
9 2. Piping specialties.
10 3. Piping joining materials.
11 4. Manual gas shutoff valves.
12 5. Motorized gas valves.
13 6. Dielectric fittings.

14 **1.3 DEFINITIONS**

- 15 A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces,
16 pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings,
17 unexcavated spaces, crawlspaces, and tunnels.
- 18 B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied
19 spaces and mechanical equipment rooms.
- 20 C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient
21 temperatures and weather conditions. Examples include rooftop locations.

22 **1.4 ACTION SUBMITTALS**

- 23 A. Product Data: For each type of the following:

- 24 1. Piping specialties.
25 2. Valves. Include pressure rating, capacity, settings, and electrical connection data of
26 selected models.
27 3. Dielectric fittings.

28 **1.5 INFORMATIONAL SUBMITTALS**

- 29 A. Welding certificates.
- 30 B. Field quality-control reports.

1 **1.6 CLOSEOUT SUBMITTALS**

2 A. Operation and Maintenance Data: For motorized gas valves to include in emergency, operation,
3 and maintenance manuals.

4 **1.7 QUALITY ASSURANCE**

5 A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1
6 / D1.1M, "Structural Welding Code - Steel."

7 B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and
8 Pressure Vessel Code.

9 C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
10 by a qualified testing agency, and marked for intended location and application.

11 **1.8 DELIVERY, STORAGE, AND HANDLING**

12 A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping
13 according to requirements of authorities having jurisdiction.

14 B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping,
15 storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and
16 moisture.

17 C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging
18 coating, and protect from direct sunlight.

19 D. Protect stored PE pipes and valves from direct sunlight.

20 **1.9 PROJECT CONDITIONS**

21 A. Perform site survey, research public utility records, and verify existing utility locations. Contact
22 utility-locating service for area where Project is located.

23 B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities
24 occupied by Owner or others unless permitted under the following conditions and then only after
25 arranging to provide purging and startup of natural-gas supply according to requirements
26 indicated:

- 27 1. Notify Owner no fewer than seven days in advance of proposed interruption of natural-
28 gas service.
- 29 2. Do not proceed with interruption of natural-gas service without Owner's written
30 permission.

31 **1.10 COORDINATION**

32 A. Coordinate sizes and locations of concrete bases with actual equipment provided.

33 B. Coordinate requirements for access panels and doors for valves installed concealed behind
34 finished surfaces.

1 **PART 2 - PRODUCTS**

2 **2.1 PERFORMANCE REQUIREMENTS**

3 A. Minimum Operating-Pressure Ratings:

- 4 1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
- 5 2. Service Regulators: 100 psig (690 kPa) minimum unless otherwise indicated.
- 6 3. Minimum Operating Pressure of Service Meter: 5 psig (34.5 kPa).

7 B. Natural-Gas System Pressures within Buildings: Three pressure ranges. Primary pressure is
 8 more than 2 psig (13.8 kPa) but not more than 5 psig (34.5 kPa), and is reduced to secondary
 9 pressures of more than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa), and is reduced
 10 again to pressures of 0.5 psig (3.45 kPa) or less.

11 **2.2 PIPES, TUBES, AND FITTINGS**

12 A. Steel Pipe: ASTM A 53 / A 53M, black steel, Schedule 40, Type E or S, Grade B.

- 13 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
- 14 2. Wrought-Steel Welding Fittings: ASTM A 234 / A 234M for butt welding and socket
 15 welding.
- 16 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint,
 17 and threaded ends.
- 18 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including
 19 bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 20 a. Material Group: 1.1.
 - 21 b. End Connections: Threaded or butt welding to match pipe.
 - 22 c. Lapped Face: Not permitted underground.
 - 23 d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings,
 24 and spiral-wound metal gaskets.
 - 25 e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel
 26 underground.

27 **2.3 PIPING SPECIALTIES**

28 A. Appliance Flexible Connectors:

- 29 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
- 30 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
- 31 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
- 32 4. Corrugated stainless-steel tubing with polymer coating.
- 33 5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
- 34 6. End Fittings: Zinc-coated steel.
- 35 7. Threaded Ends: Comply with ASME B1.20.1.
- 36 8. Maximum Length: 72 inches (1830 mm.)

37 B. Y-Pattern Strainers:

- 38 1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.

- 1 2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for
- 2 NPS 2-1/2 (DN 65) and larger.
- 3 3. Strainer Screen: 40mesh startup strainer, and perforated stainless-steel basket with 50
- 4 percent free area.
- 5 4. CWP Rating: 125 psig (862 kPa).

- 6 C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire
- 7 screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-
- 8 end connection.

9 **2.4 JOINING MATERIALS**

- 10 A. Joint Compound and Tape: Suitable for natural gas.

- 11 B. Welding Filler Metals: Comply with AWS D10.12 / D10.12M for welding materials appropriate for
- 12 wall thickness and chemical analysis of steel pipe being welded.

13 **2.5 MANUAL GAS SHUTOFF VALVES**

- 14 A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas
- 15 Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

- 16 B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with
- 17 ASME B16.33.

- 18 1. CWP Rating: 125 psig (862 kPa).
- 19 2. Threaded Ends: Comply with ASME B1.20.1.
- 20 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas
- 21 Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule"
- 22 Articles.
- 23 4. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for
- 24 valves 1 inch (25 mm) and smaller.
- 25 5. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG"
- 26 permanently marked on valve body.

- 27 C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with
- 28 ASME B16.38.

- 29 1. CWP Rating: 125 psig (862 kPa).
- 30 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
- 31 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas
- 32 Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule"
- 33 Articles.
- 34 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

- 35 D. Two-Piece, Full-Port, Bronze Ball Valves with Stainless Steel Trim: MSS SP-110.

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

- 38 a. BrassCraft Manufacturing Company; a Masco company.
- 39 b. Conbraco Industries, Inc.; Apollo Div.
- 40 c. Lyall, R. W. & Company, Inc.

- 1 d. McDonald, A. Y. Mfg. Co.
 2 e. Perfection Corporation; a subsidiary of American Meter Company.
- 3 2. Body: Bronze, complying with ASTM B 584.
 4 3. Ball: Chrome-plated stainless steel.
 5 4. Stem: Stainless steel; blowout proof.
 6 5. Seats: Reinforced TFE; blowout proof.
 7 6. Packing: Threaded-body packnut design with adjustable-stem packing.
 8 7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff
 9 Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 10 8. CWP Rating: 600 psig (4140 kPa).
 11 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL
 12 acceptable to authorities having jurisdiction.
 13 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- 14 E. Bronze Plug Valves: MSS SP-78.
- 15 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
 16 following:
- 17 a. Lee Brass Company.
 18 b. McDonald, A. Y. Mfg. Co.
- 19 2. Body: Bronze, complying with ASTM B 584.
 20 3. Plug: Bronze.
 21 4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff
 22 Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 23 5. Operator: Square head or lug type with tamperproof feature where indicated.
 24 6. Pressure Class: 125 psig (862 kPa).
 25 7. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL
 26 acceptable to authorities having jurisdiction.
 27 8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- 28 F. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
- 29 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
 30 following:
- 31 a. Flowserve.
 32 b. Homestead Valve; a division of Olson Technologies, Inc.
 33 c. McDonald, A. Y. Mfg. Co.
 34 d. Milliken Valve Company.
 35 e. Mueller Co.; Gas Products Div.
 36 f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.
- 37 2. Body: Cast iron, complying with ASTM A 126, Class B.
 38 3. Plug: Bronze or nickel-plated cast iron.
 39 4. Seat: Coated with thermoplastic.
 40 5. Stem Seal: Compatible with natural gas.
 41 6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve
 42 Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 43 7. Operator: Square head or lug type with tamperproof feature where indicated.
 44 8. Pressure Class: 125 psig (862 kPa).
 45 9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL
 46 acceptable to authorities having jurisdiction.

1 10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2 **2.6 MOTORIZED GAS VALVES**

3 A. Electrically Operated Valves: Comply with UL 429.

4 1. Basis-of-Design Product: Subject to compliance with requirements, provide ASCO 8043
5 Series or comparable product by one of the following:

- 6 a. Dungs, Karl, Inc.
- 7 b. Eclipse Combustion, Inc.
- 8 c. Goyen Valve Corp.; Tyco Environmental Systems.
- 9 d. Magnatrol Valve Corporation.
- 10 e. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve
11 Div.
- 12 f. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

- 13 2. Pilot operated.
- 14 3. Body: Brass or aluminum.
- 15 4. Seats and Disc: Nitrile rubber.
- 16 5. Springs and Valve Trim: Stainless steel.
- 17 6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
- 18 7. NEMA ICS 6, Type 4, coil enclosure.
- 19 8. Normally closed.
- 20 9. Visual position indicator.
- 21 10. Two SPST position switches for monitoring of open and closed positions by external
22 device.

23 **2.7 PRESSURE REGULATORS**

- 24 1. Single stage and suitable for natural gas.
- 25 2. Steel jacket and corrosion-resistant components.
- 26 3. Elevation compensator.
- 27 4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for
28 regulators NPS 2-1/2 (DN 65) and larger.

29 B. Line Pressure Regulators: Comply with ANSI Z21.80.

- 30 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
- 31 2. Springs: Zinc-plated steel; interchangeable.
- 32 3. Diaphragm Plate: Zinc-plated steel.
- 33 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the
34 valve port.
- 35 5. Orifice: Aluminum; interchangeable.
- 36 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 37 7. Single-port, self-contained regulator with orifice no larger than required at maximum
38 pressure inlet, and no pressure sensing piping external to the regulator.
- 39 8. Pressure regulator shall maintain discharge pressure setting downstream, and not
40 exceed 150 percent of design discharge pressure at shutoff.
- 41 9. Overpressure Protection Device: Factory mounted on pressure regulator.
- 42 10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not
43 connected to vent piping.
- 44 11. Maximum Inlet Pressure: 5 psig (34.5 kPa)

- 1 C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
- 2 1. Body and Diaphragm Case: Die-cast aluminum.
- 3 2. Springs: Zinc-plated steel; interchangeable.
- 4 3. Diaphragm Plate: Zinc-plated steel.
- 5 4. Seat Disc: Nitrile rubber.
- 6 5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
- 7 6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
- 8 7. Regulator may include vent limiting device, instead of vent connection, if approved by
- 9 authorities having jurisdiction.
- 10 8. Maximum Inlet Pressure: 2 psig (13.8 kPa).

11 **2.8 SERVICE METERS**

- 12 A. Rotary-Type Service Meters: Comply with ANSI B109.3.
- 13 1. Case: Extruded aluminum.
- 14 2. Connection: Flange.
- 15 3. Impellers: Polished aluminum.
- 16 4. Rotor Bearings: Self-lubricating.
- 17 5. Compensation: Continuous temperature and pressure.
- 18 6. Meter Index: Cubic feet
- 19 7. Tamper resistant.
- 20 8. Remote meter reader compatible.
- 21 9. Maximum Inlet Pressure: 100 psig (690 kPa) <
- 22 10. Accuracy: Maximum plus or minus 2.0 percent.

23 **PART 3 - EXECUTION**

24 **3.1 EXAMINATION**

- 25 A. Examine roughing-in for natural-gas piping system to verify actual locations of piping
- 26 connections before equipment installation.
- 27 B. Proceed with installation only after unsatisfactory conditions have been corrected.

28 **3.2 PREPARATION**

- 29 A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- 30 B. Inspect natural-gas piping according to NFPA 54 to determine that natural-gas utilization
- 31 devices are turned off in piping section affected.
- 32 C. Comply with NFPA 54 requirements for prevention of accidental ignition.

33 **3.3 OUTDOOR PIPING INSTALLATION**

- 34 A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- 35 B. Steel Piping with Protective Coating:
- 36 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

- 1 2. Replace pipe having damaged PE coating with new pipe.
- 2 C. Install fittings for changes in direction and branch connections.

3 **3.4 INDOOR PIPING INSTALLATION**

- 4 A. Comply with NFPA 54 for installation and purging of natural-gas piping.
- 5 B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- 6
- 7
- 8
- 9 C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- 10
- 11 D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- 12
- 13 E. 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.
- 14
- 15
- 16 F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- 17 G. Locate valves for easy access.
- 18 H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- 19 I. Install piping free of sags and bends.
- 20 J. Install fittings for changes in direction and branch connections.
- 21 K. Verify final equipment locations for roughing-in.
- 22 L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- 23
- 24 M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
- 25
- 26
- 27 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- 28
- 29
- 30
- 31 N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- 32
- 33 O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- 34

- 1 P. Concealed Location Installations: Except as specified below, install concealed natural-gas
 2 piping and piping installed under the building in containment conduit constructed of steel pipe
 3 with welded joints as described in Part 2. Install a vent pipe from containment conduit to
 4 outdoors and terminate with weatherproof vent cap.
- 5 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be
 6 installed in accessible spaces without containment conduit.
- 7 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from
 8 physical damage using steel striker barriers at rigid supports.
- 9 a. Exception: Tubing passing through partitions or walls does not require striker
 10 barriers.
- 11 3. Prohibited Locations:
- 12 a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash
 13 chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator
 14 shafts.
- 15 b. Do not install natural-gas piping in solid walls or partitions.
- 16 Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side
 17 down.
- 18 R. Connect branch piping from top or side of horizontal piping.
- 19 S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to
 20 each piece of equipment. Unions are not required at flanged connections.
- 21 T. Do not use natural-gas piping as grounding electrode.
- 22 U. Install strainer on inlet of each automatic or electrically operated valve.
- 23 V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for
 24 sleeves specified in Section 23 05 17 "Sleeves and Sleeve Seals for HVAC Piping."
- 25 W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with
 26 requirements for sleeve seals specified in Section 23 05 17 "Sleeves and Sleeve Seals for
 27 HVAC Piping."
- 28 X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with
 29 requirements for escutcheons specified in Section 23 05 18 "Escutcheons for HVAC Piping."
- 30 **3.5 SERVICE-METER ASSEMBLY INSTALLATION**
- 31 A. Install service-meter assemblies aboveground, on concrete bases.
- 32 B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at
 33 second regulators if two regulators are installed in series.
- 34 C. Install strainer on inlet of service-pressure regulator and meter set.
- 35 D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install
 36 screen in vent outlet if not integral with service regulator.

- 1 E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream
- 2 from service meters.
- 3 F. Install service meters downstream from pressure regulators.
- 4 G. Install metal bollards to protect meter assemblies.

5 **3.6 VALVE INSTALLATION**

- 6 A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel
- 7 tubing, aluminum, or copper connector.
- 8 B. Install regulators and overpressure protection devices with maintenance access space
- 9 adequate for servicing and testing.

10 **3.7 PIPING JOINT CONSTRUCTION**

- 11 A. Ream ends of pipes and tubes and remove burrs.
- 12 B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before
- 13 assembly.
- 14 C. Threaded Joints:
 - 15 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 16 2. Cut threads full and clean using sharp dies.
 - 17 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 18 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal
 - 19 threading is specified.
 - 20 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or
 - 21 damaged. Do not use pipe sections that have cracked or open welds.
- 22 D. Welded Joints:
 - 23 1. Construct joints according to AWS D10.12 / D10.12M, using qualified processes and
 - 24 welding operators.
 - 25 2. Bevel plain ends of steel pipe.
 - 26 3. Patch factory-applied protective coating as recommended by manufacturer at field welds
 - 27 and where damage to coating occurs during construction.

28 **3.8 HANGER AND SUPPORT INSTALLATION**

- 29 A. Comply with requirements for pipe hangers and supports specified in Section 23 05 29
- 30 "Hangers and Supports for HVAC Piping and Equipment."
- 31 B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod
- 32 sizes:
 - 33 1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size,
 - 34 3/8 inch (10 mm).
 - 35 2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch
 - 36 (10 mm).

- 1 3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm);
- 2 minimum rod size, 3/8 inch (10 mm).
- 3 4. NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90): Maximum span, 10 feet (3 m); minimum rod
- 4 size, 1/2 inch (13 mm).
- 5 5. NPS 4 (DN 100) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 5/8 inch
- 6 (15.8 mm).

7 **3.9 CONNECTIONS**

- 8 A. Connect to utility's gas main according to utility's procedures and requirements.
- 9 B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment
- 10 grounding conductor of the circuit powering the appliance according to NFPA 70.
- 11 C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- 12 D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within
- 13 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve
- 14 and appliances or equipment.
- 15 E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical
- 16 to inlet of each appliance.

17 **3.10 LABELING AND IDENTIFYING**

- 18 A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment"
- 19 for piping and valve identification.
- 20 B. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished
- 21 grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

22 **3.11 PAINTING**

- 23 A. Comply with requirements in Section 230010 "General Provisions for HVAC", Section 09 91 13
- 24 "Exterior Painting", and Section 09 91 23 "Interior Painting" for painting interior and exterior
- 25 natural-gas piping.
- 26 B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and
- 27 by procedures to match original factory finish.

28 **3.12 CONCRETE BASES**

- 29 A. Concrete Bases: Anchor equipment to concrete base.
- 30 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm)
- 31 larger in both directions than supported unit.
- 32 2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete
- 33 base, and anchor into structural concrete floor.
- 34 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting
- 35 drawings, templates, diagrams, instructions, and directions furnished with items to be
- 36 embedded.

- 1 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 2 5. Use 3000-psig (20.7-MPa), 28-day, compressive-strength concrete and reinforcement as
- 3 specified in Division 03.

4 **3.13 FIELD QUALITY CONTROL**

- 5 A. Perform tests and inspections.
- 6 B. Tests and Inspections:
 - 7 1. Test, inspect, and purge natural gas according to NFPA 54 and authorities having
 - 8 jurisdiction.
- 9 C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- 10 D. Prepare test and inspection reports.

11 **3.14 OUTDOOR PIPING SCHEDULE**

- 12 A. Aboveground natural-gas piping shall be one of the following:
 - 13 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 14 2. Steel pipe with wrought-steel fittings and welded joints.
- 15 B. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and
- 16 fittings with protective coating for steel piping.

17 **3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)**

- 18 A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
 - 19 1. Steel pipe with malleable-iron fittings and threaded joints.
- 20 B. Aboveground, distribution piping shall be one of the following:
 - 21 1. Steel pipe with malleable-iron fittings and threaded joints.
 - 22 2. Steel pipe with wrought-steel fittings and welded joints.
- 23 C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and
- 24 fittings with protective coating for steel piping.
- 25 D. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or
- 26 wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective
- 27 coating for steel piping.

28 **3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE**

- 29 A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
 - 30 1. Two-piece, full-port, bronze ball valves with bronze trim.

- 1 B. Valves for pipe sizes NPS 2-1/2 (DN 65) and larger at service meter shall be the following:
- 2 1. Cast-iron, lubricated plug valve.
- 3 C. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be the following:
- 4 1. Two-piece, full-port, bronze ball valves with stainless steel trim.
- 5 D. Distribution piping valves for pipe sizes NPS 2-1/2 (DN 65) and larger shall be the following:
- 6 1. Cast-iron, lubricated plug valve.
- 7 E. Valves in branch piping for single appliance shall be the following:
- 8 1. Two-piece, full-port, bronze ball valves with stainless steel trim.

9 **END OF SECTION 22 16 23**

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1 **SECTION 22 34 00 FUEL-FIRED, DOMESTIC-WATER HEATERS**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:
- 8 1. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
9 2. Domestic-water heater accessories.

10 **1.3 ACTION SUBMITTALS**

- 11 A. Product Data: For each type and size of domestic-water heater indicated. Include rated
12 capacities, operating characteristics, electrical characteristics, and furnished specialties and
13 accessories.
- 14 B. Shop Drawings:
- 15 1. Wiring Diagrams: For power, signal, and control wiring.

16 **1.4 INFORMATIONAL SUBMITTALS**

- 17 A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from
18 manufacturer.
- 19 B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to
20 authorities having jurisdiction.
- 21 C. Field quality-control reports.
- 22 D. Warranty: Sample of special warranty.

23 **1.5 CLOSEOUT SUBMITTALS**

- 24 A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in
25 emergency, operation, and maintenance manuals.

26 **1.6 QUALITY ASSURANCE**

- 27 A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70,
28 by a qualified testing agency, and marked for intended location and application.

- 1 B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply
- 2 with ASHRAE/IESNA 90.1.
- 3 C. ASME Compliance:
- 4 1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-
- 5 water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code:
- 6 Section VIII, Division 1.
- 7 D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable
- 8 water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

9 **1.7 COORDINATION**

- 10 A. Coordinate sizes and locations of concrete bases with actual equipment provided.

11 **1.8 WARRANTY**

- 12 A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or
- 13 replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship
- 14 within specified warranty period.
- 15 1. Failures include, but are not limited to, the following:
- 16 a. Structural failures including storage tank and supports.
- 17 b. Faulty operation of controls.
- 18 c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 19 2. Warranty Periods: From date of Substantial Completion.
- 20 a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:
- 21 1) Storage Tank: Fifteen years.
- 22 2) Heat Exchanger: Fifteen years.
- 23 3) Controls and Other Components: One year(s).
- 24 b. Compression Tanks: Five years.

25 **PART 2 - PRODUCTS**

26 **2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS**

- 27 A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:
- 28 a.
- 29 B. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:
- 30 1. Basis-of-Design Product: Subject to compliance with requirements, provide product
- 31 indicated on Drawings or comparable product by one of the following:
- 32 a. PVI Industries
- 33 b. Bradford White Corporation.

- 1 c. Lochinvar Corporation.
- 2 d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
- 3 e. State Industries.
- 4 2. Standard: ANSI Z21.10.3/CSA 4.3.
- 5 3. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure
- 6 rating.
- 7 a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to
- 8 tank before testing.
- 9 1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
- 10 b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water
- 11 tank linings, including extending finish into and through tank fittings and outlets.
- 12 c. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water
- 13 tank linings, including extending lining into and through tank fittings and outlets.
- 14 4. Factory-Installed Storage-Tank Appurtenances:
- 15 a. Anode Rod: Powered, maintenance free.
- 16 b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
- 17 c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
- 18 d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except
- 19 connections and controls.
- 20 e. Jacket: Steel with enameled finish.
- 21 f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-
- 22 gas fuel.
- 23 g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-
- 24 ignition system.
- 25 h. Temperature Control: Adjustable thermostat.
- 26 i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or
- 27 systems.
- 28 j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M.
- 29 Include one or more relief valves with total relieving capacity at least as great as
- 30 heat input, and include pressure setting less than domestic-water heater working-
- 31 pressure rating. Select one relief valve with sensing element that extends into
- 32 storage tank.
- 33 5. Special Requirements: NSF 5 construction.
- 34 6. Power-Vent System: Exhaust fan, interlocked with burner.
- 35 7. Condensate neutralization kit: Sized appropriately for the capacity of the condensing
- 36 water heater. AERCO or approved equal.

37 2.2 DOMESTIC-WATER HEATER ACCESSORIES

- 38 A. Domestic-Water Compression Tanks:
- 39 1. Manufacturers: Subject to compliance with requirements, provide products by one of the
- 40 following:
- 41 a. AMTROL, Inc.
- 42 b. Smith, A. O. Corporation.
- 43 c. State Industries.
- 44 d. Taco, Inc.

- 1 2. Description: Steel, pressure-rated tank constructed with welded joints and factory-
2 installed butyl-rubber diaphragm. Include air pre-charge to minimum system-operating
3 pressure at tank.
4 3. Construction:
- 5 a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling.
6 Include ASME B1.20.1 pipe thread.
7 b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water
8 tank linings, including extending finish into and through tank fittings and outlets.
9 c. Air-Charging Valve: Factory installed.
- 10 4. Capacity and Characteristics:
- 11 a. Working-Pressure Rating: 150 psig (1035 kPa).
12 b. Capacity Acceptable: 7 gal. (26.5 L) minimum.
13 c. Air Pre-charge Pressure: 40-psig (275-kPa).
- 14 B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to
15 ASHRAE/IESNA 90.1.
- 16 C. Heat-Trap Fittings: ASHRAE 90.2.
- 17 D. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for
18 field installation, for multiple domestic-water heater installation. Include balltype shutoff valves to
19 isolate each domestic-water heater and calibrated balancing valves to provide balanced flow
20 through each domestic-water heater.
- 21 1. Comply with requirements for balancing valves specified in Section 22 11 19 "Domestic
22 Water Piping Specialties."
- 23 E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in
24 piping.
- 25 F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include pressure rating as
26 required to match gas supply.
- 27 G. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as
28 great as heat input, and include pressure setting less than domestic-water heater working-
29 pressure rating. Select relief valves with sensing element that extends into storage tank.
- 30 1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
- 31 H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.
- 32 **2.3 SOURCE QUALITY CONTROL**
- 33 A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code
34 construction, according to ASME Boiler and Pressure Vessel Code.

1 **PART 3 - EXECUTION**

2 **3.1 DOMESTIC-WATER HEATER INSTALLATION**

- 3 A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on
4 concrete base.
- 5 1. Attachment to supported equipment.
6 2. Anchor domestic-water heaters to substrate.
- 7 B. Install domestic-water heaters level and plumb, according to layout drawings, original design,
8 and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so
9 controls and devices needing service are accessible.
- 10 1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on
11 domestic-hot-water outlet piping.
- 12 C. Install gas-fired, domestic-water heaters according to NFPA 54.
- 13 1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters
14 without shutoff valves.
15 2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters
16 without gas pressure regulators if gas pressure regulators are required to reduce gas
17 pressure at burner.
- 18 D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use
19 relief valves with sensing elements that extend into tanks. Extend commercial-water-heater
20 relief-valve outlet, with drain piping same as domestic-water piping in continuous downward
21 pitch, and discharge by positive air gap onto closest floor drain.
- 22 E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or
23 over floor drains. Install hose-end drain valves at low points in water piping for domestic-water
24 heaters that do not have tank drains. Comply with requirements for hose-end drain valves
25 specified in Section 22 11 19 "Domestic Water Piping Specialties."
- 26 F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for
27 thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."
- 28 G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters.
29 Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water
30 heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet,
31 and throttling valve in each domestic-water heater outlet. Install piping-type heat traps on inlet
32 and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat
33 traps.
- 34 H. Fill domestic-water heaters with water.
- 35 I. Charge domestic-water compression tanks with air.

36 **3.2 CONNECTIONS**

- 37 A. Comply with requirements for domestic-water piping specified in Section 22 11 16 "Domestic
38 Water Piping."

- 1 B. Comply with requirements for gas piping specified in
- 2 C. Drawings indicate general arrangement of piping, fittings, and specialties.
- 3 D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service
- 4 and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

5 **3.3 IDENTIFICATION**

- 6 A. Identify system components. Comply with requirements for identification specified in
- 7 Section 22 05 53 "Identification for Plumbing Piping and Equipment."

8 **3.4 FIELD QUALITY CONTROL**

- 9 A. Perform tests and inspections.
- 10 1. Manufacturer's Field Service: Engage a factory-authorized service representative to
- 11 inspect components, assemblies, and equipment installations, including connections, and
- 12 to assist in testing.
- 13 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest
- 14 until no leaks exist.
- 15 3. Operational Test: After electrical circuitry has been energized, start units to confirm
- 16 proper operation.
- 17 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and
- 18 equipment.
- 19 B. Domestic-water heaters will be considered defective if they do not pass tests and inspections.
- 20 C. Prepare test and inspection reports.

21 **3.5 DEMONSTRATION**

- 22 A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired,
- 23 storage, domestic-water heaters.

24 **END OF SECTION 22 34 00**

1 **SECTION 22 42 13.13 COMMERCIAL WATER CLOSETS**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 SUMMARY**

- 7 A. Section Includes:

- 8 1. Wall Mounted Water closets.

9 **1.3 DEFINITIONS**

- 10 A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

- 11 B. Remote Water Closet: Located more than 30 feet (9.1 m) from other drain line connections or
12 fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

13 **1.4 ACTION SUBMITTALS**

- 14 A. Product Data: For each type of product.

- 15 1. Include construction details, material descriptions, dimensions of individual components
16 and profiles, and finishes for water closets.
17 2. Include rated capacities, operating characteristics, electrical characteristics, and
18 furnished specialties and accessories.

- 19 B. Shop Drawings: Include diagrams for power, signal, and control wiring.

20 **1.5 CLOSEOUT SUBMITTALS**

- 21 A. Operation and Maintenance Data: For flush-o-meter valves and electronic sensors to include in
22 operation and maintenance manuals.

23 **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- 24 A. Furnish extra materials that are packaged with protective covering for storage and identified
25 with labels describing contents.

- 26 1. Flush-o-meter-Valve Repair Kits: Equal to 10 percent of amount of each type installed,
27 but no fewer than one of each type.

1 **PART 2 - PRODUCTS**

2 **2.1 WALL-MOUNTED WATER CLOSETS**

- 3 1. Support: Water closet carrier.
- 4 a. Standard: ASME A112.6.1M.
- 5 b. Description: Waste-fitting assembly as required to match drainage piping material
- 6 and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware
- 7 matching fixture. Include additional extension coupling, faceplate, and feet for
- 8 installation in wide pipe space.
- 9 c. Water-Closet Mounting Height: Standard Child or Handicapped/elderly according
- 10 to ICC/ANSI A117.1 as indicated.
- 11 2. Water-Closet Mounting Height: Standard, Child, or Handicapped/elderly according to
- 12 ICC A117.1.

13 **PART 3 - EXECUTION**

14 **3.1 EXAMINATION**

- 15 A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify
- 16 actual locations of piping connections before water-closet installation.
- 17 B. Examine walls and floors for suitable conditions where water closets will be installed.
- 18 C. Proceed with installation only after unsatisfactory conditions have been corrected.

19 **3.2 INSTALLATION**

- 20 A. Water-Closet Installation:
- 21 1. Install level and plumb according to roughing-in drawings.
- 22 2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to
- 23 piping or building substrate.
- 24 3. Install accessible, wall-mounted water closets at mounting height for
- 25 handicapped/elderly, according to ICC/ANSI A117.1.
- 26 B. Support Installation:
- 27 1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
- 28 2. Use carrier supports with waste-fitting assembly and seal.
- 29 3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto
- 30 waste-fitting seals; and attach to support.
- 31 4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and
- 32 waste-fitting seals; and affix to building substrate.
- 33 C. Flush-o-meter-Valve Installation:
- 34 1. Install flush-o-meter-valve, water-supply fitting on each supply to each water closet.
- 35 2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

- 1 3. Install lever-handle flush-o-meter valves for accessible water closets with handle
- 2 mounted on open side of water closet.
- 3 4. Install actuators in locations that are easy for people with disabilities to reach.
- 4 5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

- 5 D. Install toilet seats on water closets.

- 6 E. Wall Flange and Escutcheon Installation:

- 7 1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished
- 8 locations and within cabinets and millwork.
- 9 2. Install deep-pattern escutcheons if required to conceal protruding fittings.
- 10 3. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for
- 11 Plumbing Piping."

- 12 F. Joint Sealing:

- 13 1. Seal joints between water closets and walls and floors using sanitary-type, one-part,
- 14 mildew-resistant silicone sealant.
- 15 2. Match sealant color to water-closet color.
- 16 3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

- 17 **3.3 CONNECTIONS**

- 18 A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings
- 19 required to match water closets.

- 20 B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

- 21 C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste
- 22 and Vent Piping."

- 23 D. Where installing piping adjacent to water closets, allow space for service and maintenance.

- 24 **3.4 ADJUSTING**

- 25 A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water
- 26 closets, fittings, and controls.

- 27 B. Adjust water pressure at flush-o-meter valves to produce proper flow.

- 28 C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

- 29 **3.5 CLEANING AND PROTECTION**

- 30 A. Clean water closets and fittings with manufacturers' recommended cleaning methods and
- 31 materials.

- 32 B. Install protective covering for installed water closets and fittings.

- 33 C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

1 **END OF SECTION 22 42 13.13**

1 **SECTION 22 42 16.13 - COMMERCIAL LAVATORIES**

2 **PART 1 - GENERAL**

3 **1.1 RELATED DOCUMENTS**

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

6 **1.2 ACTION SUBMITTALS**

- 7 A. Product Data: For each type of product.
- 8 1. Include construction details, material descriptions, dimensions of individual components
9 and profiles, and finishes for lavatories.
- 10 2. Include rated capacities, operating characteristics, electrical characteristics, and
11 furnished specialties and accessories.

12 **1.3 INFORMATIONAL SUBMITTALS**

- 13 A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

14 **1.4 CLOSEOUT SUBMITTALS**

- 15 A. Operation and Maintenance Data: For lavatories and faucets to include in operation and
16 maintenance manuals.
- 17 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data,"
18 include the following:
- 19 a. Servicing and adjustments of automatic faucets.

20 **1.5 MAINTENANCE MATERIAL SUBMITTALS**

- 21 A. Furnish extra materials that match products installed and that are packaged with protective
22 covering for storage and identified with labels describing contents.
- 23 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size
24 installed.
- 25 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size
26 installed.

1 **PART 2 - PRODUCTS**

2 **2.1 LAVATORY SUPPORTS**

3 A. Wall Mounted Lavatories

- 4 1. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular,
5 steel uprights.

6 **2.2 SUPPLY FITTINGS**

- 7 A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with
8 potable water.

- 9 B. Standard: ASME A112.18.1/CSA B125.1.

- 10 C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply
11 piping size. Include chrome-plated-brass or stainless-steel wall flange.

- 12 D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet
13 connection matching supply piping.

- 14 E. Operation: cross handle.

- 15 F. Risers:

- 16 1. NPS 1/2 (DN 15).
17 2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

18 **2.3 SUPPORTS**

- 19 A. Type II Lavatory Carrier:

- 20 1. Standard: ASME A112.6.1M.

- 21 B. Type III Lavatory Carrier:

- 22 1. Standard: ASME A112.6.1M.

23 **PART 3 - EXECUTION**

24 **3.1 EXAMINATION**

- 25 A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify
26 actual locations of piping connections before lavatory installation.

- 27 B. Examine counters and walls for suitable conditions where lavatories will be installed.

- 28 C. Proceed with installation only after unsatisfactory conditions have been corrected.

1 **3.2 INSTALLATION**

- 2 A. Install lavatories level and plumb according to roughing-in drawings.
- 3 B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- 4 C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people
5 with disabilities or the elderly, according to ICC/ANSI A117.1.
- 6 D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
7 Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with
8 escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."
- 9 E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-
10 resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements
11 specified in Section 07 92 00 "Joint Sealants."
- 12 F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of
13 accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping
14 Insulation."

15 **3.3 CONNECTIONS**

- 16 A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent
17 piping. Use size fittings required to match fixtures.
- 18 B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."
- 19 C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste
20 and Vent Piping."

21 **3.4 ADJUSTING**

- 22 A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories,
23 fittings, and controls.
- 24 B. Adjust water pressure at faucets to produce proper flow.
- 25 C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

26 **3.5 CLEANING AND PROTECTION**

- 27 A. After completing installation of lavatories, inspect and repair damaged finishes.
- 28 B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning
29 methods and materials.
- 30 C. Provide protective covering for installed lavatories and fittings.
- 31 D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

1 **END OF SECTION 22 42 16.13**