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USACE / NAVFAC / AFCESA / NASA **UFGS 22 00 70 (November 2011)**

Preparing Activity: USACE **Superseding UFGS 22 00 70 (February 2011)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2012
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SECTION 22 00 70

PLUMBING, HEALTHCARE FACILITIES

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SECTION 22 00 70

PLUMBING, HEALTHCARE FACILITIES
11/11

****
NOTE: This specification covers the requirements for plumbing systems in healthcare facilities.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable items(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

PART 1 GENERAL

****
NOTE: This guide specification includes plumbing fixtures, equipment, and piping which is located within, on, under, and adjacent to buildings. Plumbing system requirements must conform to Federal Standard FED-STD-795, "Uniform Federal Accessibility Standards (UFAS)," Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities, and Department of Defense (DoD) adopted and approved International Plumbing Code (ICC IPC), as modified by UFC 1-200-1 "General Building Requirements", Military Handbook MIL-HDBK-1190, "Facility Planning and Design Guide", UFC 4-510-01, "Design: Medical Military Facilities", and UFC 3-420-1, "Design: Plumbing Systems". Equipment supports and connections, for either equipment on the ground or in the building, shall conform to

these requirements.

Show following information on project drawings:

1. Only drawings (not specifications) must indicate capacity, efficiency, dimensions, details, plan view, sections, elevations, locations of fixtures and equipment, and space required to replace strainers, filters, and for maintenance of equipment.

2. Location of wye strainer on building side of water supply valve in each building; indicate wye strainer blow-off outlet with piping to adjacent exterior wall hydrant (this will clean the strainer each time the wall hydrant is used).

3. Configuration, slope, and location of each piping system such as: above or below floors, above or below ceilings, above or below roofs, above or below ground.

4. Location of each sectionalizing valve in each water system. Sectionalizing valves must be ball valves.

5. Location of each solenoid-operated flush valve and solenoid-operated lavatory faucet.

****

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a reference ID outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1/CSA 4.1 (2009; Addenda 2009) Gas Water Heaters

	Vol. I, Storage Water Heaters with Input Ratings of 75,000 Btu Per Hour or Less
ANSI Z21.10.3/CSA 4.3	(2011) Gas Water Heaters Vol.III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous
ANSI Z21.22/CSA 4.4	(1999; Addenda A 2000, Addenda B 2001; R 2004) Relief Valves for Hot Water Supply Systems

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE 90.1 - IP	(2010; INT 1 2011; Errata 2011, Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI	(2010; Errata 2011; INT 2-12 2011) Energy Standard for Buildings Except Low-Rise Residential Buildings

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2008) Performance Requirements for Atmospheric Type Vacuum Breakers (ANSI approved 2009)
ASSE 1003	(2009) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI approved 2010)
ASSE 1010	(2004) Performance Requirements for Water Hammer Arresters (ANSI approved 2004)
ASSE 1011	(2004; Errata 2004) Performance Requirements for Hose Connection Vacuum Breakers (ANSI approved 2004)
ASSE 1012	(2009) Performance Requirements for Backflow Preventer with an Intermediate Atmospheric Vent - (ANSI approved 2009)
ASSE 1013	(2009) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
ASSE 1018	(2001) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2011) Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type (ANSI Approved

	2004)
ASSE 1020	(2004; Errata 2004; Errata 2004) Performance Requirements for Pressure Vacuum Breaker Assembly (ANSI Approved 2004)
ASSE 1037	(1990) Performance Requirements for Pressurized Flushing Devices (Flushometers) for Plumbing Fixtures

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C203	(2008) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(2011) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C652	(2011) Disinfection of Water-Storage Facilities
AWWA C700	(2009) Standard for Cold Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(2007) Standard for Cold-Water Meters - Turbine Type for Customer Service
AWWA D100	(2011) Welded Steel Tanks for Water Storage

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2011) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.1/B2.1M	(2009) Specification for Welding Procedure and Performance Qualification
AWS B2.2/B2.2M	(2010) Specification for Brazing Procedure and Performance Qualification

ASME INTERNATIONAL (ASME)

ASME A112.1.2	(2004) Standard for Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)
ASME A112.14.1	(2003; R 2008) Backwater Valves

ASME A112.19.2/CSA B45.1	(2008; Update 1 2009; Update 2 2011) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.3/CSA B45.4	(2008; Update 1 2009; Update 2 2011) Stainless Steel Plumbing Fixtures
ASME A112.36.2M	(1991; R 2008) Cleanouts
ASME A112.6.1M	(1997; R 2008) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2001; R 2007) Standard for Floor and Trench Drains
ASME A112.6.4	(2003: R 2008) Roof, Deck and Balcony Drains
ASME B1.20.1	(1983; R 2006) Pipe Threads, General Purpose (Inch)
ASME B1.20.2M	(2006; R 2011) Pipe Threads, 60 Deg. General Purpose (Metric)
ASME B16.18	(2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2011) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.22	(2001; R 2010) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2002; R 2006) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.29	(2007) Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.34	(2009; Supp 2010) Valves - Flanged, Threaded and Welding End
ASME B16.5	(2009) Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B31.1	(2010) Power Piping
ASME B31.5	(2010) Refrigeration Piping and Heat Transfer Components
ASME B40.100	(2005; R 2010) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2010) BPVC Section IV-Rules for Construction of Heating Boilers

ASME BPVC SEC IX	(2010) BPVC Section IX-Welding and Brazing Qualifications
ASME BPVC SEC VIII D1	(2010) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASME CSD-1	(2009) Control and Safety Devices for Automatically Fired Boilers

ASTM INTERNATIONAL (ASTM)

ASTM A105/A105M	(2011) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2003; R 2009) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2011) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A47/A47M	(1999; R 2009) Standard Specification for Ferritic Malleable Iron Castings
ASTM A515/A515M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2010) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 2008) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A53/A53M	(2010) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
ASTM A74	(2009) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A861	(2004; R 2008) Standard Specification for High-Silicon Iron Pipe and Fittings
ASTM A888	(2011) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B111/B111M	(2011) Standard Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock

ASTM B117	(2011) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2009) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2009) Standard Specification for Copper Drainage Tube (DWV)
ASTM B32	(2008) Standard Specification for Solder Metal
ASTM B36/B36M	(2008a) Standard Specification for Brass Plate, Sheet, Strip, and Rolled Bar
ASTM B370	(2011) Standard Specification for Copper Sheet and Strip for Building Construction
ASTM B584	(2011) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B75	(2002; R 2010) Standard Specification for Seamless Copper Tube
ASTM B75M	(1999; R 2011) Standard Specification for Seamless Copper Tube (Metric)
ASTM B813	(2010) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B88	(2009) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2005; R 2011) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C1053	(2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM C564	(2011) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2011) Standard Specification for Elastomeric Joint Sealants
ASTM D2000	(2008) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2657	(2007) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2822/D2822M	(2005e1; R 2011) Asphalt Roof Cement
ASTM D2846/D2846M	(2009be1) Chlorinated Poly(Vinyl Chloride)

	(CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D3139	(1998; R 2011) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2007) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311	(2011) Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D4101	(2011) Standard Specification for Polypropylene Injection and Extrusion Materials
ASTM D635	(2010) Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position
ASTM E1	(2007) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM E2129	(2010) Standard Practice for Data Collection for Sustainability Assessment of Building Products
ASTM F 1290	(1998a; R 2011) Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F 477	(2010) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F1412	(2009) Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems
ASTM F2618	(2009) Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2009) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2011) Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications

COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA A4015	(1994; R 1995) Copper Tube Handbook

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR Manual	(1988e9) Manual of Cross-Connection Control

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO UPC	(2003) Uniform Plumbing Code
IAPMO Z124.1.2	(2005) Plastic Bathtub and Shower Units
IAPMO Z124.5	(2006) Plastic Toilet (Water Closet) Seats

INTERNATIONAL CODE COUNCIL (ICC)

ICC IPC	(2009) International Plumbing Code
ICC/ANSI A117.1	(2009) Accessible and Usable Buildings and Facilities

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z358.1	(2009) American National Standard for Emergency Eyewash and Shower Equipment

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2008) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2002a) Butterfly Valves
MSS SP-69	(2003) Pipe Hangers and Supports - Selection and Application (ANSI Approved American National Standard)
MSS SP-70	(2006) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2005) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2005a) Cast Iron Plug Valves, Flanged and Threaded Ends

MSS SP-80	(2008) Bronze Gate, Globe, Angle and Check Valves
MSS SP-85	(2002) Gray Iron Globe & Angle Valves Flanged and Threaded Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(1992; R 2007) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2009) Motors and Generators
NEMA MG 11	(1977; R 2007) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2011) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2012) National Fuel Gas Code
NFPA 90A	(2012) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF/ANSI 14	(2011a) Plastics Piping System Components and Related Materials
NSF/ANSI 61	(2011) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2010) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI G 101	(2010) Testing and Rating Procedure for Hydro Mechanical Grease Interceptors with Appendix of Installation and Maintenance
PDI WH 201	(2010) Water Hammer Arresters Standard

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(2009) Hose Clamp Specifications

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

PL 93-523	(1974; A 1999) Safe Drinking Water Act

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 430	Energy Conservation Program for Consumer Products
40 CFR 143	National Secondary Drinking Water Regulations
40 CFR 50.12	National Primary and Secondary Ambient Air Quality Standards for Lead
PL 102-486	(1992) Residential Energy Efficiency Ratings

UNDERWRITERS LABORATORIES (UL)

UL 174	(2004; Reprint Jul 2011) Household Electric Storage Tank Water Heaters
UL 1951	(2011) Electric Plumbing Accessories
UL 499	(2005; Reprint Mar 2011) Electric Heating Appliances
UL 508	(1999; Reprint Apr 2010) Industrial Control Equipment
UL 732	(1995; Reprint Apr 2010) Oil-Fired Storage Tank Water Heaters
UL 778	(2010; Reprint Aug 2011) Standard for Motor-Operated Water Pumps

1.2 SYSTEM DESCRIPTION

Provide complete and operable plumbing systems including sanitary and storm drainage, domestic water, plumbing fixtures, valves, pumps, water heaters, supports, and all associated appurtenances.

1.2.1 Sustainable Design Requirements

1.2.1.1 Local/Regional Materials

****
NOTE: Using local materials can help minimize transportation impacts, including fossil fuel consumption, air pollution, and labor.

This is optional for Army projects.
****

Use materials or products extracted, harvested, or recovered, as well as manufactured, within a [800] [_____] km [500] [_____] mile radius from the project site, if available from a minimum of three sources. Submit documentation indicating distance between manufacturing facility and the

project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project.

1.2.1.2 Environmental Data

****
NOTE: ASTM E2129 provides for detailed documentation of the sustainability aspects of products used in the project. This level of detail may be useful to the Contractor, Government, building occupants, or the public in assessing the sustainability of these products.

This is optional for Army projects.
****

Submit documentation indicating percentage of post-industrial and post-consumer recycled content per unit of product. Indicate relative dollar value of recycled content products to total dollar value of products included in project. [Submit Table 1 of ASTM E2129 for the following products: [_____].]

1.2.2 Performance Requirements

1.2.2.1 Cathodic Protection and Pipe Joint Bonding

Provide cathodic protection and pipe joint bonding systems in accordance with [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [and] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)][Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODE] [and] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT] and Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT).

1.2.2.2 Plumbing Fixtures

Water flow and consumption rates shall, at a minimum, comply with requirements in PL 102-486.

1.2.3 Accessibility of Equipment

****
NOTE: The following requirement is intended to solicit the installer's help in the prudent location of equipment when he has some control over locations. However, designers should not rely on it at all since enforcing this requirement in the field would be difficult. Therefore, the system designer needs to layout and indicate the locations of equipment, control devices, and access doors so that most of the accessibility questions are resolved inexpensively during design.
****

Install all work so that parts requiring periodic inspection, operation, maintenance, and repair are readily accessible. Install concealed valves, and equipment requiring access, in locations freely accessible through access doors.

1.3 SUBMITTALS

****

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item, if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Plumbing System; G, [_____]

SD-03 Product Data

Local/Regional Materials
Environmental Data
Pipe and Fittings[; G][; G[, [_____]]]
Pipe Hangers, Inserts, and Supports[; G][; G[, [_____]]]
Valves[; G][; G[, [_____]]]
Plumbing Fixtures[; G][; G[, [_____]]]
Backflow Preventers[; G][; G[, [_____]]]
Drains and Backwater Valves[; G][; G[, [_____]]]
Cleanouts[; G][; G[, [_____]]]
Interceptors[; G][; G[, [_____]]]
Water Heaters[; G][; G[, [_____]]]

Storage Tanks[; G][; G[, [_____]]]
Pumps[; G][; G[, [_____]]]
Water Pressure Booster System[; G][; G[, [_____]]]
Water Service Meter[; G][; G[, [_____]]]
Copper-silver Ionization System[; G][; G[, [_____]]]
Vibration-Absorbing Features[; G][; G[, [_____]]]
Plumbing System

SD-06 Test Reports

Tests, Flushing and Disinfection
Test of Backflow Prevention Assemblies[; G][; G[, [_____]]].

SD-07 Certificates

Materials and Equipment
Welding
Bolts
EPA registration for Copper-Silver Ionization
NSF certification for Copper-Silver Ionization

SD-10 Operation and Maintenance Data

Plumbing System[; G][; G[, [_____]]]

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

a. Manufacturer qualifications: Manufacturers shall be regularly engaging in the manufacturing, supplying, and servicing of specified products and equipment, as well as, providing engineering and/or start-up services as specified. Provide evidence demonstrating compliance for a minimum of 5 years, and on 5 projects of similar complexity.

b. Installer qualifications: Installer shall be licensed, and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade. Installation of the following items/systems shall be done by authorized representatives of respective manufacturers:

1. Water Pressure Booster Pump System.

2. Copper-silver Ionization System.

1.4.2 Welding

****
NOTE: The designer will indicate welding requirements on the project drawings. Normally, delete the second bracketed statement. If the need exists for more stringent requirements for weldments, delete the first bracketed statement and the welding submittal.
****

[Weld piping in accordance with qualified procedures using performance-qualified welders and welding operators. Submit a list of names and identification symbols of qualified welders and welding

operators. Provide documentation that welders, and welding operators are certified in accordance with American Welding Society Standard AWS B2.1/B2.1M. Qualify procedures and welders in accordance with ASME BPVC SEC IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer, may be accepted as permitted by ASME B31.1. Notify the Contracting Officer 24 hours in advance of tests, and perform the tests at the work site if practicable. Welders or welding operators shall apply their assigned symbols near each weld they make as a permanent record.] [Welding and nondestructive testing procedures are specified in Section 40 05 13.96 WELDING PROCESS PIPING.] [Weld structural members in accordance with Section 05 05 23 WELDING, STRUCTURAL.]

1.4.3 Regulatory Requirements

1.4.3.1 International Code Council (ICC) Codes

Unless otherwise required herein, perform plumbing work in accordance with the ICC IPC.

a. For ICC Codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word "should" shall be interpreted as "shall." Reference to the "code official" shall be interpreted to mean the "Contracting Officer." For Navy owned property, references to the "owner" shall be interpreted to mean the "Contracting Officer." For leased facilities, references to the "owner" shall be interpreted to mean the "lessor." References to the "permit holder" shall be interpreted to mean the "Contractor."

b. For ICC Codes referenced in the contract documents, the provisions of Chapter 1, "Administrator," do not apply. These administrative requirements are covered by the applicable Federal Acquisition Regulations (FAR) included in this contract and by the authority granted to the Officer in Charge of Construction to administer the construction of this project. References in the ICC Codes to sections of Chapter 1, shall be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

1.4.3.2 Referenced Publications

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction", or words of similar meaning, to mean the Contracting Officer.

1.4.4 Alternative Qualifications

Products having less than a two-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturer's factory or laboratory tests, can be shown.

1.4.5 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment

installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.5 DELIVERY, STORAGE, AND HANDLING

Handle, store, and protect equipment and materials to prevent damage before and during installation in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer. Replace damaged or defective items.

1.6 MAINTENANCE

Provide extra materials as follows:

a. Four additional cartridges for each waterless urinal installed along with any tools needed to remove/install the cartridge. Provide an additional quart of biodegradable liquid for each urinal installed.

b. One spare electrode cell for the copper-silver ionization system.

PART 2 PRODUCTS

2.1 STANDARD PRODUCTS

Provide materials and equipment which are the standard products of a manufacturer regularly engaged in the manufacture of such products. Specified equipment shall essentially duplicate equipment that has performed satisfactorily at least two years prior to bid opening. Provide standard products that have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year use shall include applications of equipment and materials under similar circumstances and of similar size. The product shall have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2 year period.

2.2 MANUFACTURER'S NAMEPLATE

Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable. See also paragraph "Nameplates" in PART 3.

2.3 MATERIALS AND EQUIPMENT

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NOTE: Some materials listed are superior to others for specific requirements. Therefore, information should be obtained from the using service for any special requirements before selection of material is made. The type of tubing or pipe required will be as determined by local experience. In the absence of actual experience with water characteristics, the selection of materials for pipe, tubing, and tanks will be made by reference to the classification of water into categories as listed in UFC 3-420-01. Chap 4. Preference will be given to the following materials for waste pipe: 100 percent recycled content cast iron. Preference should be given, in this order, to the following materials for supply

pipe: copper, galvanized steel.

This specification allows drainage systems up to 375 mm (15 inch) diameter only; designer will ensure the availability of materials when drainage line exceeds 375 mm (15 inch) diameter.

Nonpressure pipe is an EPA designated product for recycled content. See Section 01 62 35 RECYCLED/RECOVERED MATERIALS and include recycled content options unless designer determines that justification for non-use exists. Designer must verify that products meeting the indicated minimum recycled content are available, preferably from at least three sources, to ensure adequate competition. If not, write in suitable recycled content values that reflect availability and competition.

Plastic pipe shall not be used unless specifically required by the circumstances of the using facility such as availability of materials in remote locations and/or trained installers.

****

Submit manufacturer's catalog data with highlighting to show model, size, options, etc., that are intended for consideration. Provide adequate data to demonstrate compliance with contract requirements. Submit certificate stating that the design, fabrication, and installation conform to the code, where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code.

a. [Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service shall bear the NSF seal "NSF-PW." Polypropylene pipe and fittings shall conform to dimensional requirements of Schedule 40, Iron Pipe size. Plastic pipe shall not be installed in air plenums. Plastic pipe shall not be installed in a pressure piping system in buildings greater than three stories including any basement levels. PVC pipe shall contain a minimum of [25] [100] percent recycled content, with a minimum of [5] [15] percent post-consumer recycled content. HDPE pipe shall contain a minimum of [100] [_____] percent post-consumer recycled content.]

b. [Cast-iron pipe shall contain a minimum of [100] [_____] percent recycled content.] Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors.

c. Cement pipe shall contain recycled content as specified in [Section 03 30 00.00 10 CAST-IN-PLACE CONCRETE] [Section 03 30 00 CAST-IN-PLACE CONCRETE].

d. Provide steel pipe containing a minimum of [25] [30] [100] percent recycled content, with a minimum of [16] [67] percent post-consumer recycled content. Select pipe schedules based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Pipe threads (except dry seal) shall conform to ASME B1.20.2MASME B1.20.1. Grooved pipe couplings and fittings shall

be from the same manufacturer.

e. Material or equipment containing lead shall not be used in any potable water system. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. End point devices such as water coolers, lavatory faucets, kitchen and bar faucets, ice makers, supply stops and end point control valves used to dispense water for drinking shall meet the requirements of NSF/ANSI 61, Section 9.

2.4 PIPE AND FITTINGS

2.4.1 Domestic Water Piping

Domestic water piping at service entrance (from 300 mm 1 foot inside building to 1525 mm 5 feet outside): Same as indicated for outside utilities.

a. 50 mm 2 inches and smaller after service entrance above grade:

(1) Copper tube conforming to ASTM B88M ASTM B88, type L, with soldered joints and wrought copper ASME B16.22 or cast brass ASME B16.18 fittings.

(2) Copper tube extracted branch taps with brazed joints are acceptable where the tapped pipe is at least 25 mm 1 inch diameter and where branch is at least 2 pipe sizes smaller.

****
NOTE: Do NOT use the following paragraph for Navy projects.
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(3) Press fittings for Copper Pipe and Tube: Copper press fittings shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. Sealing elements for copper press fittings shall be EPDM, FKM or HNBR. Sealing elements shall be factory installed or an alternative supplied fitting manufacturer. Sealing element shall be selected based on manufacturer's approved application guidelines.

b. Below grade:

(1) Copper tube conforming to ASTM B88M ASTM B88, type K soft, with brazed joints and wrought copper ASME B16.22 fittings.

(2) Where below-grade run of piping is shorter than 15 m 50 feet, below-grade joints are not acceptable.

c. 65 to 100 mm 2-1/2 to 4 inches after service entrance:

(1) Copper tube conforming to ASTM B88M ASTM B88, type L, with soldered joints and wrought copper ASME B16.22 or cast brass ASME B16.18 fittings.

(2) Copper tube conforming to ASTM B88M ASTM B88, type L, with roll-groove joints and manufactured grooved fittings conforming to ASTM B75 C12200 or ASTM B152/B152M C1100 and ASME B16.22 for

wrought copper, or per ASTM B584 copper alloy CDA 836 (85-5-5-5) per ASME B16.18.

d. 125 mm 5 inches and larger after service entrance:

(1) Seamless or welded, hot-dipped galvanized steel conforming to ASTM A53/A53M or ASTM B36/B36M with roll grooved joints and galvanized, malleable-iron, grooved fittings and couplings.

(2) Copper tube conforming to ASTM B88M ASTM B88, type L, with soldered joints and wrought copper ASME B16.22 fittings.

(3) Copper tube conforming to ASTM B88M ASTM B88, type L, with roll-groove joints and manufactured grooved fittings conforming to ASTM B75 C12200 or ASTM B152/B152M C1100 and ASME B16.22 for wrought copper, or per ASTM B584 copper alloy CDA 836 (85-5-5-5) per ASME B16.18.

****
NOTE: Include in renovation where necessary.
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(4) [Connections to existing galvanized piping: Threaded, mechanical groove, mechanical plain-end, or flanged.]

2.4.2 Deionized Water Piping

CPVC Plastic Pipe, Fittings, and Solvent Cement: ASTM D2846/D2846M, Schedule 40 CPVC. Provide transition union connections or threaded gate valve between copper tubing and chlorinated polyvinyl chloride (CPVC) piping. Provide male threaded adapters with PTFE (polytetrafluoroethylene) pipe thread paste for threaded connections to valves, strainers, and equipment.

2.4.3 Drainage Piping (Soil, Waste, Vent, Indirect, and Storm)

a. Above grade:

(1) Cast-iron conforming to ASTM A74, hubbed pipe and fittings with ASTM C564 elastomeric push joints.

(2) Cast-iron conforming to CISPI 301 or ASTM A888, hubless pipe, fittings, and CISPI 310 elastomeric sealing sleeves with stainless-steel or cast iron clamps.

(3) Copper tube conforming to ASTM B306, type DWV or heavier, with soldered joints and wrought copper ASME B16.29 or cast brass ASME B16.23 drainage and vent fittings. Piping within MRI shielding shall be copper.

(4) Seamless or welded, hot-dipped galvanized steel conforming to ASTM A53/A53M or ASTM B36/B36M, cast iron drainage type fittings, galvanized malleable vent fittings and threaded joints.

b. Below grade: Cast-iron conforming to ASTM A74, hubbed pipe and fittings with ASTM C564 elastomeric push joints.

2.4.4 Drainage Piping (Corrosive Waste)

a. Above grade:

(1) Corrosive waste borosilicate glass conforming to ASTM C1053, with mechanical joints and borosilicate glass fittings.

(2) Corrosive waste cast iron (14 percent silica) pipe and fittings conforming to ASTM A518/A518M and ASTM A861. Mechanical joints, and bell and spigot joints are acceptable in exposed (accessible) locations. Bell and spigot joints only are acceptable in concealed (non-accessible) locations.

[(3) Corrosive waste Schedule 40 fire retardant polypropylene DWV pipe and fittings conforming to ASTM D4101, ASTM F1412, ASTM D635, and ASTM D3311. Mechanical joints, and fused joints are acceptable in exposed (accessible) locations. Fused joints only are acceptable in concealed (non-accessible) locations.]

(4) Chlorinated Polyvinyl Chloride Chemical DWV piping system complying with ASTM F2618 and socket (solvent cement) joints.

b. Below grade:

(1) Corrosive waste cast iron (14 percent silica) pipe and fittings conforming to ASTM A518/A518M and ASTM A861, with bell and spigot joints.

[(2) Corrosive waste Schedule 80 polypropylene DWV pipe and fittings conforming with ASTM D4101 and ASTM D3311 with fused joints.]

(3) Chlorinated Polyvinyl Chloride Chemical DWV piping system complying with ASTM F2618 and socket (solvent cement) joints.

2.4.5 Pressure Drainage Piping

[a. Cast iron pressure pipe and fittings, with mechanical joints.]

b. Galvanized steel, cast iron drainage fittings with threaded joints.

2.4.6 Exposed Piping in Finished Areas

a. Chrome or nickel plated brass to wall or floor.

b. Piping 50 mm 2 inches and larger may be provided with chrome or nickel plated brass sleeves to cover pipe and fittings in lieu of plating.

[2.4.7 Trap Primer Pipe Between Primer Device and Drain

a. Above grade: Copper tube conforming to ASTM B88M ASTM B88, type K or L, with soldered joints and wrought copper ASME B16.22 or cast brass ASME B16.18 fittings.

b. Below grade: Copper tube conforming to ASTM B88M ASTM B88, type K soft, with soldered joints and wrought copper ASME B16.22 or cast brass ASME B16.18 fittings.

]2.5 PIPE JOINT MATERIALS

Grooved pipe and hubless cast-iron soil pipe shall not be used under ground. Solder containing lead shall not be used with copper pipe. Mark cast iron soil pipe and fittings with the collective trademark of the Cast Iron Soil Pipe Institute. Joints and gasket materials shall conform to the following:

a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310

b. Coupling for Steel Pipe: AWWA C606.

c. Couplings for Grooved Pipe: [Ductile Iron ASTM A536 (Grade 65-45-12)] [Malleable Iron ASTM A47/A47M, Grade 32510]. [Copper ASTM A536].

d. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm 1/16 inch thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.

e. Brazing Material: Brazing material shall conform to AWS A5.8/A5.8M, BCuP-5.

f. Brazing Flux: Flux shall be in paste or liquid form appropriate for use with brazing material. Flux shall be as follows: lead-free; have a 100 percent flushable residue; contain slightly acidic reagents; contain potassium borides; and contain fluorides.

g. Solder Material: Solder metal shall conform to ASTM B32 and be Code approved "Lead Free" having a chemical composition equal to or less than 0.2 percent lead.

h. Solder Flux: Flux shall be liquid form, non-corrosive, Code approved "Lead Free" and conform to ASTM B813, Standard Test 1.

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NOTE: Low corrosion flux for copper pipe can help reduce potentially toxic releases from soldered copper pipe.

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i. PTFE Tape: PTFE Tape, for use with Threaded Metal or Plastic Pipe.

j. Rubber Gaskets for Cast-Iron Soil-Pipe and Fittings (hub and spigot type and hubless type): ASTM C564.

k. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 110 degrees C 230 degrees F.

l. Flexible Elastomeric Seals: ASTM D3139, ASTM D3212 or ASTM F 477.

m. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.

n. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the

manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M. Submit written certification by the bolt manufacturer that the bolts furnished comply with the specified requirements.

2.6 MISCELLANEOUS MATERIALS

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NOTE: For jobs at Newport, R.I. use diaphragm type only.
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Miscellaneous materials shall conform to the following:

a. Water Hammer Arrester: PDI WH 201. [Water hammer arrester shall be [diaphragm] [or] [piston] type.]

b. Copper, Sheet and Strip for Building Construction: ASTM B370.

c. Asphalt Roof Cement: ASTM D2822/D2822M.

d. Hose Clamps: SAE J1508.

e. Supports for Off-The-Floor Plumbing Fixtures: ASME A112.6.1M.

f. Metallic Cleanouts: ASME A112.36.2M.

g. Plumbing Fixture Setting Compound: A preformed flexible ring seal molded from hydrocarbon wax material. The seal material shall be nonvolatile nonasphaltic and contain germicide and provide watertight, gastight, odorproof and verminproof properties.

h. Coal-Tar Protective Coatings and Linings for Steel Water Pipelines: AWWA C203.

i. Hypochlorites: AWWA B300.

j. Liquid Chlorine: AWWA B301.

k. Gauges - Pressure Indicating Dial Type - Elastic Element: ASME B40.100.

l. Thermometers: ASTM E1. Mercury shall not be used in thermometers.

2.7 PIPE INSULATION MATERIAL

Provide insulation as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.8 PIPE HANGERS, INSERTS, AND SUPPORTS

Provide pipe hangers, inserts, and supports conforming to MSS SP-58 and MSS SP-69. Hangers in MRI Suite shall be non-ferrous (copper, aluminum, stainless steel).

2.9 VALVES

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NOTE: Drawings will indicate equipment isolation, branch, and sectionalizing valves for water systems. Valves will be provided so that system maintenance can be performed without complete system shutdown. In general, valves should be provided in the following locations:

a. Each branch serving a group of fixtures.

b. Each riser serving a group of fixtures.

c. Isolation valves will be provided on the supply and discharge of booster and circulating pumps and on all water heaters.

****

Provide valves on supplies to equipment and fixtures. Valves 65 mm 2-1/2 inches and smaller shall be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm 3 inches and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Description	Standard
Butterfly Valves	MSS SP-67
Cast-Iron Gate Valves, Flanged and Threaded Ends	MSS SP-70
Cast-Iron Swing Check Valves, Flanged and Threaded Ends	MSS SP-71
Ball Valves with Flanged Butt-Welding Ends for General Service	MSS SP-72
Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends	MSS SP-110
Cast-Iron Plug Valves, Flanged and Threaded Ends	MSS SP-78
Bronze Gate, Globe, Angle, and Check Valves	MSS SP-80
Steel Valves, Socket Welding and Threaded Ends	ASME B16.34
Cast-Iron Globe and Angle Valves, Flanged and Threaded Ends	MSS SP-85
Backwater Valves	ASME A112.14.1
Vacuum Relief Valves	ANSI Z21.22/CSA 4.4
Water Pressure Reducing Valves	ASSE 1003
Water Heater Drain Valves	ASME BPVC SEC IV, Part HLW-810
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4

Description	Standard
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code, Part CW, Article 5

2.10 PLUMBING FIXTURES

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NOTE: The systems specified for water use in a building can dramatically impact both the quantity of water resources used and the quality. Installed fixtures and systems should be life-cycle cost-effective. Low-flow and zero-flow fixtures and accessories (such as waterless urinals and sensor operators) may require special training. Because these technologies may be different from the systems and materials with which the Government personnel are familiar, education about the environmental qualities as well as the operation and maintenance requirements may be necessary. Refer to Section 01 45 00.00 10 QUALITY CONTROL SYSTEM (QCS) and 01 45 00.00 10 QUALITY CONTROL, 01 45 00.10 20 QUALITY CONTROL FOR MINOR CONSTRUCTION and/or 01 45 00.00 20 QUALITY CONTROL, 01 45 00.00 40 QUALITY CONTROL.

Reducing potable water consumption and wastewater discharge in buildings contributes to the following LEED credits: WE2; WE3.

Water quality for most buildings is largely determined by the municipal water treatment facility. Most water treatment facilities rely upon chemicals, including chlorine, to combat pathogens. Chlorine is highly reactive and readily forms chlorinated compounds, many of which are considered to be dangerous. Chlorinated hydrocarbons, such as DDT, have been and are used as pesticides. If this is a concern for a given location, include the bracketed chlorine filter requirement in the lavatory, sink, cooler, shower and bathtub specification paragraphs below. The ARMY and the NAVY do not provide chlorine filters to their domestic water outlets.

These paragraphs cover fixtures most often specified. The selection of fixture requirements is based on MIL-STD-1691 to the most practicable extent. The fixture listing will be revised for each project by deleting inapplicable items. The various types of fixtures will be identified by corresponding mark numbers shown on the drawings. A maximum of acceptable fixture and trim options should be allowed for materials in this specification, unless life cycle analysis or local experience indicates that one type of material is

better suited than others. Use separate hot and cold water valves. For fixture mounting heights see paragraph FIXTURES AND FIXTURE TRIMMINGS.

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2.10.1 General

Fixtures shall be water conservation type, in accordance with ICC IPC. Fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1. Provide vitreous china fixtures that are nonabsorbent, hard-burned, and vitrified throughout the body. No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Equip fixtures with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system shall be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts shall be provided for supports, and polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Internal parts of flush and/or flushometer valves, shower mixing valves, shower head face plates, [may contain acetal resin, fluorocarbon, nylon, acrylonitrile-butadiene-styrene (ABS) or other plastic material, if the material has provided satisfactory service under actual commercial or industrial operating conditions for not less than 2 years] [shall be copper alloy with all visible surfaces chrome plated].[Plastic in contact with hot water shall be suitable for 82 degrees C 180 degrees F water temperature.] Maximum allowable lead content in wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures, as determined by a weighted average shall not exceed 0.25 percent.

2.10.2 Flushometer Valves

Provide flushometer valves with an ADA compliant, metal oscillating, non-hold-open handle, backcheck angle control stop, and vacuum breaker. Flushometer valves shall be either a large diaphragm, or fixed volume piston type with filtered metering bypass. Valve shall not be able to be converted externally or internally to exceed a low consumption flush. Handle packing, main seat, stop seat and vacuum breaker shall be molded from a chloramine resistant rubber compound. Provide valve body, cover, tailpiece and control stop in conformance with ASTM Alloy Classification for semi-red brass. All exposed surfaces shall be chrome plated. Handle shall have factory applied antimicrobial coating. Flushometer valves shall conform to ASSE 1037.

2.10.3 Automatic Controls

Where specified with a fixture, provide automatic, sensor operated faucets complying with ASSE 1037 and UL 1951. Faucet systems shall consist of solenoid-activated valves with light beam sensors.

[2.10.4 Service Sinks

ASME A112.19.2/CSA B45.1, white vitreous china with integral back and wall hanger supports, minimum dimensions of 559 mm 22 inches wide by 508 mm 20 inches front to rear, with two supply openings in 254 mm 10 inch high back. Provide floor supported wall outlet cast iron P-trap and stainless steel rim guards as recommended by service sink manufacturer. Provide back mounted washerless service sink faucets with vacuum breaker and 19 mm 3/4 inch external hose threads.

]2.10.5 Fixture Descriptions

2.10.5.1 Electric Water Coolers

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NOTE: Designer will indicate location, type, and capacity of the water cooler on the drawings. All requirements will be indicated. Designer will add to the specification required data on construction, supports, and insulation.
****

Provide self-contained, mechanically refrigerated electric water coolers with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-hung, bubbler style, air-cooled condensing unit, stainless steel splash receptor and basin, and stainless steel cabinet. Provide 8.4 mL/s 8 gph minimum capacity of 10 degrees C 50 degrees F water when supplied with 27 degrees C 80 degrees F inlet water and a 32 degrees C 90 degrees F room temperature. Control bubblers by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts shall be mounted at maximum of 914 mm 36 inches above floor and at front of unit basin with 686 mm 27 inch minimum knee clearance from bottom of unit to finished floor. Spouts shall direct water flow at least 102 mm 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit. Provide chrome plated 10 mm 3/8 inch OD soft-copper tube supplies with set-screw escutcheons, and loose key stops. Provide chrome plated 32 x 40 mm 1-1/4 x 1-1/2 inch semi-cast P-trap with cleanout with 1.1 x 38 mm 17 gage x 1-1/2 inch chrome plated copper tube trap arm with set-screw escutcheon.[Provide filters for chlorine in supply piping to faucets.] Provide ASME A112.6.1M concealed steel pipe chair carriers.

a. EWC-1 (JSN R2201): Accessible (forward facing), dual-level, recessed, brushed stainless steel, recessed refrigeration unit, dual level extensions with oval receptors, access panel cover, rounded corners, rounded edges, designed to eliminate splashing and standing waste water. Provide self-closing, semi-circular push bars with full 180 degree activation.

b. EWC-2 (Similar to JSN R2202): Self-contained, wall hung, mechanically refrigerated.

2.10.5.2 Emergency Fixtures

Provide copper alloy control valves. Provide an air-gap with the lowest potable eye and face wash water outlet located above the overflow rim by not less than the International Plumbing Code minimum. [Provide a pressure-compensated tempering valve, with leaving water temperature setpoint adjustable throughout the range 16 to 35 degrees C 60 to 95 degrees F.] [Provide packaged, UL listed, alarm system; including an amber strobe lamp, horn with externally adjustable loudness and horn silencing switch, mounting hardware, and waterflow service within NEMA Type 3 or 4 enclosures[and for explosion proof service within NEMA Type 7 or 9 enclosures].]

a. EW-1 (Similar to JSN P1960): Eye/face wash, ANSI/ISEA Z358.1, deck-mounted, swing down, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valve. Spray heads swing down from storage to operational position activating water flow. Coordinate

configuration with sink faucet location. Unit shall deliver 0.19 L/s 3 gpm of aerated water at 207 kPa 30 psi flow pressure.

b. EW-2 (JSN P2000): Eye/face wash, ANSI/ISEA Z358.1, wall-mounted self-cleaning, non-clogging eye and face wash with quick opening, full-flow valves, corrosion-resisting steel eye and face wash receptor. Unit shall deliver 0.19 L/s 3 gpm of aerated water at 207 kPa 30 psi flow pressure, with eye and face wash nozzles 838 to 1143 mm 33 to 45 inches above finished floor. Provide 32 mm 1-1/4 inch standard chrome drain fitting.

****
NOTE: Intended for use in finished areas such as laboratories.
****

c. ES-1 (Similar to JSN P5210): Combination drench shower and eye/face wash, ANSI/ISEA Z358.1. All exposed surfaces shall be stainless steel. Recessed eye/face wash and shower actuator assembly. Eye/face wash, swing down, self-cleaning, non-clogging eye and face wash with quick opening, full-flow valve. Spray heads swing down from storage to operational position activating water flow. Eye/face wash shall deliver 0.19 L/s 3 gpm of aerated water at 207 kPa 30 psi flow pressure. Shower head shall be a minimum of 203 mm 8 inch diameter designed for [vertical] [horizontal] [recessed] supply piping. Shower valve shall be 25 mm 1 inch IPS brass stay-open valve with stainless steel "panic bar" actuator. Shower shall deliver 1.89 L/s 30 gpm flow and 508 mm 20 inch pattern at 1524 mm 60 inches above floor. Eye/face wash and shower actuator shall be mounted in [separate] [combined] stainless steel fully recessed cabinet with flanged rim and suitable for mounting in 92 mm 3 5/8 inch stud wall. [This unit shall be suitable for and installed for handicap access.]

****
NOTE: Intended for use in unfinished areas such as mechanical rooms.
****

d. ES-2 (JSN P5210): Combination drench shower and eye/face wash, ANSI/ISEA Z358.1. Components shall be mounted on a minimum 32 mm 1-1/4 inch diameter [stainless steel] [chrome plated brass] [galvanized steel] pipe stanchion with floor flange. Provide chrome plated split ring support to adjacent wall surface 305 mm 12 inches below shower arm connection. Eye/face wash, swing down, self-cleaning, non-clogging eye and face wash with quick opening, 13 mm 1/2 inch IPS chrome-plated brass full-flow push to activate stay-open valve. Eye/face wash shall deliver 0.19 L/s 3 gpm of aerated water at 207 kPa 30 psi flow pressure. Shower head shall be a minimum of 203 mm 8 inch diameter. Shower valve shall be 25 mm 1 inch IPS chrome-plated brass stay-open valve with stainless steel actuating arm and pull rod. Shower shall deliver 1.89 L/s 30 gpm flow and 508 mm 20 inch pattern at 1524 mm 60 inches above floor. [This unit shall be suitable for and installed for handicap access.]

2.10.5.3 Lavatories

a. Provide ASME A112.19.2/CSA B45.1, white vitreous china, integral back type wall hung lavatories with supply openings for use with top mounted faucet, and openings for concealed arm carrier installation. Provide

chrome plated 10 mm 3/8 inch OD soft-copper tube supplies with set-screw escutcheons, and loose key stops. Provide chrome plated 32 x 40 mm 1-1/4 x 1-1/2 inch semi-cast P-trap with cleanout with 1.1 x 38 mm 17 gage x 1-1/2 inch chrome plated copper tube trap arm with set-screw escutcheon. Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports and concealed arms for the lavatory. Mount lavatory with the front rim 787 mm 31 inches above the floor, except 864 mm 34 inches above floor and with 737 mm 29 inches minimum clearance from bottom of the front rim to floor for accessible lavatories.

****
NOTE: L-1, L-2, L-6 and L-7 are intended for use in public toilet rooms. Where sensor operation is indicated, battery (or solar with battery backup) operated unit is preferred but hard wired unit shall be used if desired by the using agency/facility. L-6 is a countertop mounted lavatory. L-2 is not sensor operated. L-1 is not intended for accessible locations.
****

(1) L-1 (Similar to JSN P3200): 508 x 457 mm 20 x 18 inches. Fixture shall be equipped with, electronic infra-red operated 100 mm 4 inch centerset combination faucet with aerator, drain fitting with grid strainer, "P" trap, and angle or straight stop valves. Automatic water flow starts electronically by proximity of individual. [Provide wiring box, 120/24 volt solenoid, remote mounted transformer. Transformer may be sized for multiple adjacent lavatories.] [Provide either a battery operated unit or a solar powered unit with battery backup.] Flow shall be limited to 0.03 L/s 0.5 gpm at a flowing pressure of 549 kPa 80 psi.

****
NOTE: Intended for use in public toilet rooms for accessible locations.
****

(2) L-2: Same as L-1 except accessible mounting height per ICC/ANSI A117.1. Provide accessible protection on exposed water supplies and "P" trap and drain piping.

****
NOTE: Intended for use in patient/staff toilet rooms.
****

(3) L-3 (Similar to JSN P3100): 508 x 610 mm 20 x 18 inches. Fixture shall be equipped with combination faucet, elevated gooseneck spout with laminar flow outlet, 100 mm 4 inch wrist action handles, drain fitting with grid strainer, "P" trap, and angle or straight stop valves. Faucet body shall not have a pop-up drain rod hole. Plugged holes are not acceptable. The flow shall be limited to 0.09 L/s 1.5 gpm at a flowing water pressure of 549 kPa 80 psi.

****
NOTE: Intended for use in patient/staff toilet rooms for accessible locations.

****

(4) L-4: Same as L-3 except accessible mounting height per ICC/ANSI A117.1. Provide accessible protection on exposed water supplies and "P" trap and drain piping.

****
NOTE: Intended for use in exam rooms for USACE projects. For Navy projects use S-1 in exam rooms.
****

(5) L-5 (Similar to JSN P3100): 508 x 610 mm 20 x 18 inches. Fixture shall be equipped with combination faucet, elevated gooseneck spout with laminar flow outlet, 100 mm 4 inch wrist action handles, drain fitting with grid strainer, "P" trap, and angle or straight stop valves. Faucet body shall not have a pop-up drain rod hole. Plugged holes are not acceptable. The flow shall be limited to 0.09 L/s 1.5 gpm at a flowing water pressure of 549 kPa 80 psi. Accessible mounting height per ICC/ANSI A117.1. Provide accessible protection on exposed water supplies and "P" trap and drain piping.

b. ASME A112.19.2/CSA B45.1, white vitreous china, self-rimming counter-mounted lavatories with supply openings for use with top mounted faucet. Furnish template and mounting kit by lavatory manufacturer. Provide chrome plated 10 mm 3/8 inch OD soft-copper tube supplies with set-screw escutcheons, and loose key stops. Provide chrome plated 32 x 40 mm 1-1/4 x 1-1/2 inch semi-cast P-trap with cleanout with 1.1 x 38 mm 17 gage x 1-1/2 inch chrome plated copper tube trap arm with set-screw escutcheon. [Provide filters for chlorine in supply piping to faucets.]

****
NOTE: Intended for use in public toilet rooms. Battery operated unit (or solar powered unit with battery backup) is preferred, but hard wired unit shall be used if desired by the using agency/facility.
****

(1) L-6 (Similar to JSN P3070): 508 x 457 mm 20 x 18 inches. Fixture shall be equipped with, electronic infra-red operated 100 mm 4 inch centerset combination faucet with aerator, drain fitting with grid strainer, "P" trap, and angle or straight stop valves. Automatic water flow starts electronically by proximity of individual. Provide wiring box, 120/24 volt solenoid, remote mounted transformer. Transformer may be sized for multiple adjacent lavatories. [Provide either a battery operated unit or a solar powered unit with battery backup.] Flow shall be limited to 0.03 L/s 0.5 gpm at a flowing pressure of 549 kPa 80 psi.

****
NOTE: Intended for use in public toilet rooms for accessible locations.
****

(2) L-7: Same as L-6 except provide accessible protection on exposed water supplies and "P" trap and drain piping.

****
NOTE: Intended for use in patient toilet rooms.
****

(3) L-8 (Similar to JSN P3070): 508 x 457 mm 20 x 18 inches. Fixture shall be equipped with 100 mm 4 inch centerset combination faucet with laminar flow outlet, elevated gooseneck spout with laminar flow outlet, 100 mm 4 inch wrist action handles, drain fitting with grid strainer, "P" trap, and angle or straight stop valves. Faucet body shall not have a pop-up drain rod hole. Plugged holes are not acceptable. Flow shall be limited to 0.09 L/s 1.5 gpm at a flowing pressure of 549 kPa 80 psi. Accessible mounting height per ICC/ANSI A117.1. Provide accessible protection on exposed water supplies and "P" trap and drain piping.

2.10.5.4 Mop Service Basin

a. [Provide terrazzo mop sinks made of marble chips cast in white portland cement to produce 25 MPa 3000 psi minimum compressive strength 7 days after casting. Provide floor or wall outlet copper alloy body drain cast integral with terrazzo, with polished stainless steel strainers.]

b. MS-1 (JSN P4700): 914 x 610 x 254 mm 36 x 24 x 10 inches, [molded polyester/fiberglass product, built under heat and pressure, resulting in a one-piece, homogeneous product] [precast terrazzo] with service faucet, hose, hose racket, and mop hanger.

2.10.5.5 Plaster Traps

a. PT-1 (JSN P7600): Large, 406 mm 16 inches high by 356 mm 14 inches wide by 356 mm 14 inches long; shall have heavy gray cast-iron body, white porcelain-enamel inside and outside; clamps, cage of heavy galvanized material, and brass screens; with 50 mm 2 inch long inlet and 50 mm 2 inch high outlet fitted with hood seal.

b. PT-2 (JSN P7650): Small, 254 mm 10 inches high by 152 mm 6 inches wide by 152 mm 6 inches long; shall be cast aluminum, rectangular with solid top and hinged bottom having integral baffles and 6 mm 1/4 inch drain plug; bolted bottom shall provide easy access for removal of screens for cleaning and recovery of items in sediment bucket.

2.10.5.6 Showers

****
NOTE: For Marine Air Corps Station, New River, and Camp LeJeune NC, use ball type control handles, not lever type control handle, when handicap accessibility is not required for the shower valves.
****

Provide single control pressure equalizing shower valves with body mounted from behind the wall with threaded connections. Provide tubing mounted from behind the wall between faucets and shower assembly. Provide separate globe valves or angle valves with union connections in each supply to faucet. The top of drain outlets shall be chromium-plated or polished stainless steel. [Provide shower valve with ball type control handle.] [Provide precast terrazzo shower floors made of marble chips cast in white portland cement to produce 25 MPa 3000 psi minimum compressive strength 7 days after casting. Provide floor or wall outlet copper alloy body drain

cast integral with terrazzo floor, with polished stainless steel strainers.]

****
NOTE: Intended for use in patient toilet rooms with ceramic tile enclosures.
****

a. SH-1 (JSN P5040): Wall mounted detachable spray assembly, 600 mm 24 inch wall bar, elevated vacuum breaker, supply elbow and flange and valve. All external trim, chrome plated metal. Plastic shower head with flow control to limit discharge to 0.110 L/s 1.75 gpm, 1500 mm 5 foot length of rubber lined corrosion resistant steel, chrome plated metal flexible, or white vinyl reinforced hose and supply wall elbow. Design showerhead to fit in palm of hand. Provide corrosion resistant steel or chrome plated metal wall bar with an adjustable swivel hanger for showerhead. Fasten wall bar securely to wall for hand support. Combination thermostatic and pressure anti-scald balancing valve, with chrome plated metal lever type operating handle adjustable for rough-in variations and chrome plated metal or corrosion resistant steel face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, corrosion resistant steel or thermoplastic material. Valve inlet and outlet shall be 13 mm 1/2 inch IPS. Provide external screwdriver check stops, vacuum breaker and temperature limit stops. Set stops for a maximum temperature of 40 degrees C 105 degrees F. All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 0.379 L/s at 310 kPa 6 gpm at 45 psi pressure drop.

****
NOTE: Intended for use in staff toilet rooms with ceramic tile enclosures.
****

b. SH-2 (Similar to JSN P5040): Wall mounted, shower head connected to shower arm. All external trim shall be chrome plated metal. Chrome plated metal head, adjustable ball joint, self cleaning with automatic flow control device to limit discharge to not more than 0.110 L/s 1.75 gpm. Body, internal parts of shower head and flow control fittings shall be copper alloy or corrosion resistant steel. Install showerhead 1800 mm 72 inches above finished floor. Combination thermostatic and pressure anti-scald balancing valve, with chrome plated metal lever with adjustment for rough-in variations, type operating handle and chrome plated brass or corrosion resistant steel face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, corrosion resistant steel or thermoplastic material. Valve inlet and outlet shall be 13 mm 1/2 inch IPS. Provide external screwdriver check stops, and temperature limit stops. Set stops for a maximum temperature of 40 degrees C 105 degrees F. Install valve 1370 mm 54 inches from bottom of shower receptor. All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 0.379 L/s at 310 kPa 6 gpm at 45 psi pressure drop.

c. SH-3 (JSN P5350): Psychiatric patient, vandal-resistant with thermostatic valve in cabinet; shower head shall be designed for prison use. Fixture shall have smooth surfaces with no projection that can be used as a catch or hook; shall have flat back arranged for bolting directly to the wall; shall be tapped for 13 mm 1/2 inch pipe connection to tempered water line; the head shall have a tamperproof removable face not less than 90 mm 3-1/2 inch diameter; and the shower

head shall be installed not less than 1829 mm 6 feet above the floor and shall deliver the spray within a 900 mm 3 foot circle. Flow shall be limited to 0.16 L/s 2.5 gpm at a flowing water pressure of 549 kPa 80 psi.

****
NOTE: Provide dimensions.
****

[d. Shower enclosures shall be [_____] mm [_____] inches wide, [_____] mm [_____] inches deep, and [_____] mm [_____] inches high. Cabinet shall be reinforced acrylic conforming to IAPMO Z124.1.2.]

****
NOTE: Show shower pans on the architectural detail. Shower pans may be omitted for showers located on floors with slab-on-grade construction, unless special local conditions necessitate waterproofing.
****

e. Shower Pan: Sheet copper shall be 4.9 kg per square meter 16 ounce weight.

2.10.5.7 Sinks

****
NOTE: Confirm casework dimensions prior to selection of sinks.

Pedal valves provide savings in locations where water is unnecessarily left running continuously during use, like kitchens.
****

Provide ASME A112.19.3/CSA B45.4, Type 302(18-8) or 304(18-8) stainless steel sinks with integral mounting rim for flush installation, with undersides fully sound deadened, with supply openings for use with top mounted faucet, and with 89 mm 3.5 inch drain outlet. Sink depth less than or equal to 250 mm 10 inch shall be 18 gage. Sink depth greater than 250 mm 10 inch shall be 16 gage. Provide aerator with faucet. Water flow rate shall not exceed 90 mL per second 1.5 gpm when measured at a flowing water pressure of 414 kPa 60 psi. Provide chrome plated 10 mm 3/8 inch OD soft-copper tube supplied with set-screw escutcheons, and loose key stops. Provide chrome plated 40 mm 1-1/2 inch semi-cast P-trap with cleanout with 1.1 x 38 mm 17 gage x 1-1/2 inch chrome plated copper tube trap arm with set-screw escutcheon. Provide separate 38 mm 1.5 inch P-trap and drain piping to vertical vent piping from each compartment. Coordinate hole quantities, locations, and centerings with faucet types indicated in fixture descriptions. Provide exact numbers of holes necessary. Use of faucet hole covers is not acceptable. Dimensions given are overall, and bowl in the following order: front to back, left to right, depth. [Provide filters for chlorine in supply piping to faucets.] Sinks located in casework designated as handicap accessible shall be same as specified except the basin depth shall not be greater than 165 mm 6-1/2 inches and the drain outlet shall be located to the rear of the basin.

****
NOTE: S-1 is typically used for Navy projects as

exam room sink.

****

a. S-1 (JSN CS010): Single bowl, counter-mounted, 460 x 380 x 165 mm 18 x 15 x 6-1/2 inches, bowl 305 x 305 x 165 mm 12 x 12 x 6-1/2 inches. Drain outlet shall be located to the rear of the basin. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

b. S-2 (JSN CS080): Single bowl, counter-mounted, 508 x 560 x 190 mm 20 x 22 x 7-1/2 inches, bowl 355 x 457 x 190 mm 14 x 18 x 7-1/2 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

c. S-3 (JSN CS090): Single bowl, counter-mounted, 560 x 560 x 190 mm 22 x 22 x 7-1/2 inches, bowl 406 x 480 x 190 mm 16 x 19 x 7-1/2 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

d. S-4 (JSN CS140): Single bowl, counter-mounted, 560 x 430 x 254 mm 22 x 17 x 10 inches, bowl 400 x 355 x 254 mm 16 x 14 x 10 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

e. S-5 (JSN CS150): Single bowl, counter-mounted, 560 x 560 x 254 mm 22 x 22 x 10 inches, bowl 406 x 408 x 254 mm 16 x 19 x 10 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

f. S-6 (JSN CS180): Single bowl, counter-mounted, 560 x 635 x 305 mm 22 x 25 x 12 inches, bowl 400 x 560 x 305 mm 16 x 22 x 12 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

g. S-7 (JSN CS200): Single bowl, counter-mounted, 560 x 787 x 305 mm 22 x 31 x 12 inches, bowl 400 x 711 x 305 mm 16 x 28 x 12 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

h. S-8 (JSN CS230): Double bowl, counter-mounted, 560 x 840 x 254 mm 22 x 33 x 10 inches, each bowl 400 x 355 x 254 mm 16 x 14 x 10 inches. Faucet shall be 200 mm 8 inch spread, single handle, swing spout.

i. S-9 (JSN CS250): Single bowl, counter-mounted, 380 x 380 x 150 mm 15 x 15 x 6 inches, bowl 230 x 305 x 150 mm 9 x 12 x 6 inches. Faucet shall be 100 mm 4 inch centerset with two 100 mm 4 inch wristblades and 125 mm 5 inch diameter fixed gooseneck spout.

j. S-10 (JSN P3520): Sink, plaster, 560 x 760 x 241 mm 22 x 30 x 9-1/2 inches; vitreous china; faucet with 51 mm 2 inch spray, 150 mm 6 inch handles, screwdriver stops, grid drain 40 mm 1-1/2 inch tailpieces, 51 mm 2 inch O.D. drain connection to trap and wall; plaster-interceptor trap (PT-1), space shall be left above for removal of screens. Provide with floor-mounted heavy-duty type sink carrier with acid-resisting white coated exposed arms and hanger support plate.

2.10.5.8 Sink, Flushing Rim

SF-1 (JSN P6350): 760 x 510 x 460 mm 30 x 20 x 18 inches; vitreous china

with an integral flushing rim to include faucet with fork brace 150 mm 6 inch handles, 260 mm 10-1/4 inches wall to spout outlet, and plain end spout with bucket hook; stainless steel spring type front and side rim guards and 100 mm 4 inch outlet. Provide flushometer valve. Provide 254 mm 10 inch high terrazzo base.

2.10.5.9 Sink, Surgeons Scrub

a. SSS-1 (JSN P6980): Three station, wall-mounted, gooseneck spouts, knee push controls. Construction shall be of seamless welded 16 gauge, Type 304, stainless steel. Cabinet shall be sound-deadened with a fire-resistant material. Unit shall be wall mounted using a mounting carrier. Front panels shall be easily removed for access to the water control valves, waste connections, stops and strainers. Sink bottoms shall be sloping to minimize splashing and a 40 mm 1-1/2 inch OD tailpiece with an 80 mm 3 inch flat strainer drain. Provide each compartment (station) with a gooseneck assembly with a 40 mm 1-1/2 inch sprayhead that can be removed for sterilization. Provide adjustable thermostatic mixing valve with anti-scald feature for each compartment and controlled from the top mounted control panel. Provide mechanical pilot type water control valves for each compartment actuated by one push of a knee-operated front panel and turned off by a second push. Plastic splash shield shall be provided between compartments. Provide knee-controlled soap dispensers at each compartment.

[b. SSS-2 (Similar to JSN P6990): Three station, wall-mounted, gooseneck spouts, electronically timed with long (10 minute) and short (3, 4, 5 minute) cycles. Construction shall be of seamless welded 16 gauge, Type 304, stainless steel. Cabinet shall be sound-deadened with a fire-resistant material. Unit shall be wall mounted using a mounting carrier. Front panels shall be easily removed for access to the water control valves, waste connections, stops and strainers. Sink bottoms shall be sloping to minimize splashing and a 40 mm 1-1/2 inch OD tailpiece with an 80 mm 3 inch flat strainer drain. Provide each compartment (station) with a gooseneck assembly with a 40 mm 1-1/2 inch sprayhead that can be removed for sterilization. Provide adjustable thermostatic mixing valve with anti-scald feature for each compartment and controlled from the top mounted control panel. Control shall be watertight and top mounted. Timing device shall be internal to reduce tampering. Plastic splash shield shall be provided between compartments. Provide foot-controlled soap dispensers at each compartment. Sink shall include 120 volt, 2 ampere power to an internal junction box.]

2.10.5.10 Urinals

a. Provide ASME A112.19.2/CSA B45.1, white vitreous china, wall-mounted, wall outlet, urinals with integral trap, drain line connection, and extended side shields. The trap design shall comply with the IPC. Install urinal rim 610 mm 24 inches above the floor at non-accessible locations. Urinals installed in compliance with ADA requirements shall be mounted with the rim 430 mm 17 inches above the floor. Provide ASME A112.6.1M concealed chair carriers. Urinals equipped with flush valves shall have a flushing volume of the urinal and flush valve combination not exceeding the fixture design rating. Mount flush valves not less than 279 mm 11 inches above the fixture.

****

NOTE: Battery operated unit (or solar powered with

battery backup) is preferred, but hard wired unit shall be used if desired by the using agency/facility.

****

(1) U-1 (Similar to JSN P8100): High efficiency washout for solenoid valve. The maximum water use allowed shall be 0.47 L 0.125 gallon per flush at a flowing water pressure of 549 kPa 80 psi. Flushing cycle shall be activated by an electronic infrared sensor operated by proximity of individual. [Provide wiring box, 120/24 volt solenoid, and transformer.] [Provide either battery operated unit or solar powered unit with battery backup.]

(2) U-2: Same as U-1 except accessible mounting height per ICC/ANSI A117.1.

(3) U-3: (Similar to JSN P8100): High efficiency washout for solenoid valve. The maximum water use allowed shall be 1.9 L 0.5 gallon per flush at a flowing water pressure of 549 kPa 80 psi. Flushing cycle shall be activated by an electronic infrared sensor operated by proximity of individual. [Provide wiring box, 120/24 volt solenoid, and transformer.] [Provide either battery operated unit or solar powered unit with battery backup.]

(4) U-4: Same as U-3 except accessible mounting height per ICC/ANSI A117.1.

****

NOTE: Specify ultra-low flow urinals, unless the user requests waterless urinals.

****

(5) U-5 (Similar to JSN P8150): Waterless. Sealed replaceable cartridge or integral liquid seal trap shall use a biodegradable liquid to provide the seal and maintain a sanitary and odor-free environment. Mechanical seal trap not permitted. Slope the sanitary sewer branch line a minimum of 6 mm per 300 mm 0.25 inch per foot. Drain lines that connect to the urinal outlet shall not be made of copper. Manufacturer shall provide an operating manual and onsite training for the proper care and maintenance of the urinal.

6. U-6: Same as U-5 except accessible mounting height per ICC/ANSI A117.1.

2.10.5.11 Water Closets

a. Provide ASME A112.19.2/CSA B45.1, white vitreous china, elongated bowl, wall-hung water closets. The trap design shall comply with the IPC. Install top of toilet seat 356 to 381 mm 14 to 15 inches, above the floor at non-accessible locations. Water closets installed in compliance with ADA requirements shall be mounted with rim of seat 432 to 483 mm 17 to 19 inches above the floor. Water closets equipped with flush valves shall have a flushing volume of the water closet and flush valve combination not exceeding the fixture design rating. Water flushing volume of the water closet and flush valve combination shall not exceed 6 liters 1.6 gallons per flush. Provide white solid plastic elongated open-front seat without cover, with check hinge. Seat shall conform to IAPMO Z124.5. Mount flush valves not less than 279 mm 11

inches above the fixture. Mounted height of flush valve shall not interfere with the hand rail in ADA stalls. Provide ASME A112.6.1M heavy duty 227 kg 500 pound capacity chair carriers.

****

NOTE: Intended for use in public/staff toilet rooms. Battery operated unit (or solar powered with battery backup) is preferred, but hard wired unit shall be used if desired by the using agency/facility.

****

(1) WC-1 (Similar to JSN P9050): Siphon-jet for direct flushometer valve. Flushometer valve shall be dual-flush type. Flushing cycle shall be activated by an electronic infrared sensor operated by proximity of individual. [Provide wiring box 120/24 volt solenoid and transformer.] [Provide either a battery operated unit or a solar powered unit with battery backup.] The maximum water use allowed shall be 6 liters 1.6 gallons per flush when sensor indicates user has been in proximity for approximately a minute or more and 4 liters 1.1 gallons per flush when user is in proximity for less than a minute.

(2) WC-2 (Similar to JSN P9050): Same as WC-1 except accessible mounting height per ICC/ANSI A117.1 Provide riser with grab bar offset.

(3) WC-3 (Similar to JSN P9000): High efficiency (HET), siphon-jet for flushometer valve. High efficiency washout for solenoid valve. The maximum water use allowed shall be 4.8 L 1.28 gallons per flush at a flowing water pressure of 549 kPa 80 psi. Flushing cycle shall be activated by an electronic infrared sensor operated by proximity of individual. [Provide wiring box, 120/24 volt solenoid, and transformer.] [Provide battery operated unit or solar operated unit with battery backup.]

(4) WC-4 (Similar to JSN P9050): Same as WC-3 except accessible mounting height per ICC/ANSI A117.1. Provide riser with grab bar offset.

****

NOTE: Intended for use in patient toilet rooms.

****

(5) WC-5 (Similar to JSN P9050): Siphon jet with bowl provided with lugs or slots for holding bedpan. Bedpan cleaner (P1150) shall be for mounting on water closet having exposed flush valve; provided with wall support bracket; and brass valve body having a taper machined type leakproof, raise and lower spray arm; and using one-third of flush water volume to rinse pan, balance to flush waste.

6. WC-6 (Similar to JSN P9050): Same as WC-5 except accessible mounting height per ICC/ANSI A117.1. Provide riser with grab bar offset.

2.10.5.12 Hose Bibbs and Hydrants

****

NOTE: Indicate on the drawings height of hose bibbs and hydrants above finished grade. In locations where the 99.6 percent design temp is 32 degrees F (0 degrees C) or less provide freezeproof hydrants.

****

a. HB-1: Hose bibb with vacuum-breaker backflow preventer, brass construction with 19 mm 3/4 inch male inlet threads, hexagon shoulder, and 19 mm 3/4 inch hose connection. Handle shall be securely attached to stem.

b. HB-2: Wall hydrant (freezeproof) ASSE 1019 with vacuum-breaker backflow preventer and shall have a nickel-brass or nickel-bronze wall plate or flange with nozzle and detachable key handle. Provide brass or bronze operating rod within a galvanized iron casing of sufficient length to extend through the wall so that the valve is inside the building, and the portion of the hydrant between the outlet and valve is self-draining. Provide brass or bronze valve with coupling and union elbow having metal-to-metal seat. Valve rod and seat washer shall be removable through the face of the hydrant. Provide hydrant with 19 mm 3/4 inch exposed hose thread on spout and 19 mm 3/4 inch male pipe thread on inlet.

c. HB-3: Yard hydrant (non-freezeproof) of brass construction, with either straight or angle bodies, and shall be of the compression type. Provide body flange with internal pipe thread to suit 19 mm 3/4 inch pipe. Body shall be suitable for wrench grip. Provide faucet spout with 19 mm 3/4 inch exposed hose threads. Faucet handle shall be securely attached to stem.

d. HB-4: Yard hydrants (freezeproof), yard box or post hydrants with valve housings located below frost lines. Water from the casing shall be drained after valve is shut off. Hydrant shall be bronze with cast-iron box or casing guard. "T" handle key shall be provided.

2.11 BACKFLOW PREVENTERS

****

NOTE: Indicate on the drawings all locations where backflow preventers are required (and type of device) to protect water supply and distribution system against backflow and backsiphonage in accordance with the International Plumbing Code. If a drain is required, ensure it is shown. Backflow prevention device requirements for connection to nongovernment potable water systems will be coordinated with the local jurisdiction and/or water service agency. Reduced-pressure principle assemblies shall be used for all domestic water services.

****

Backflow preventers shall be approved and listed by the Foundation For Cross-Connection Control & Hydraulic Research. Reduced-pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure type vacuum breakers shall be tested, approved, and listed in accordance with FCCCHR Manual. Backflow preventers with intermediate atmospheric vent shall conform to ASSE 1012. Reduced pressure principle backflow preventers shall conform to ASSE 1013. Hose

connection vacuum breakers shall conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers shall conform to ASSE 1001. Pressure vacuum breaker assembly shall conform to ASSE 1020. Air gaps in plumbing systems shall conform to ASME A112.1.2.

2.12 DRAINS AND BACKWATER VALVES

****
NOTE: Where a trap seal is subject to loss by evaporation, a deep-seal trap consisting of a 100 mm (4 inch) seal or a trap seal primer valve shall be used. Deep-seal traps are the preferred method in lieu of trap primers. If a trap seal primer valve is chosen, it shall be of the electrically timed, solenoid valve type not dependent on pressure fluctuations to operate.
****

Drains and backwater valves installed in connection with waterproofed floors or shower pans shall be equipped with bolted-type device to securely clamp flashing.

2.12.1 Area Drains

****
NOTE: Area drains intended for use in accessible areaways such as at the bottom of exterior stairs.
****

a. Provide area drains with coated [galvanized] cast iron bodies for embedding in the floor construction. The grate/strainer shall be plain pattern perforated or slotted. Provide with threaded outlet connection. Between the outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Drain shall conform to ASME A112.6.3. Grate/strainer weight loading classification is based on ASME A112.6.3. Dimensions are nominal.

b. AD-1: 300 mm 12 inch overall [diameter] [width], 200 mm 8 inch diameter grate, 150 mm 6 inch depth, with [removable] [hinged], light-duty cast iron grate with minimal free area of 2 times free area of outlet pipe size. Provide with backwater valve.

2.12.2 Floor and Shower Drains

Provide floor and shower drains with coated [galvanized] cast iron bodies, double drainage pattern for embedding in the floor construction, and seepage pan having weep holes or channels for drainage to the drainpipe. The grate/strainer shall be adjustable to floor thickness. Provide an integral clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane when required. Provide with threaded outlet connection. Between the outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Grate/strainer weight loading classification is based on ASME A112.6.3. Dimensions are nominal.[Provide drain with trap primer connection, trap primer, and connection piping.]

****
NOTE: FD-1 intended for use in mechanical equipment rooms and unfinished spaces.
****

a. FD-1: 300 mm 12 inch diameter flashing collar, 100 mm 4 inch deep body and 200 mm 8 inch diameter removable, non-tilt heavy-duty cast iron grate with minimal free area of 1.5 times free area of outlet pipe size.

****
NOTE: FD-2 intended for use in toilet rooms, shower floors, and finished spaces.
****

b. FD-2: 250 mm 10 inch diameter invertible flashing collar, 50 mm 2 inch deep body, and minimum 150 mm 6 inch [square] [diameter] removable, secured, light-duty nickel bronze strainer with minimum free area of 1.5 times free area of outlet pipe size.

****
NOTE: FD-3 intended for use in mechanical equipment rooms with isolated floor slabs.
****

[c. FD-3: 300 mm 12 inch diameter flashing collar, 50 mm 2 inch deep body, and 200 mm 8 inch diameter non-tilt heavy-duty cast iron grate with minimal free area of 1.5 times free area of outlet pipe size. Provide with 400 mm 16 inch diameter isolation floor drain body with flange, integral clamping collar, and standpipe.]

2.12.3 Floor Sinks

Provide floor sinks with coated [galvanized] cast iron bodies, with acid-resisting interior, and double drainage pattern for embedding in the floor construction, and seepage pan having weep holes or channels for drainage to the drainpipe. Provide an integral clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane when required. Provide with threaded outlet connection. Between the outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor sinks shall conform to ASME A112.6.3. Provide aluminum sediment bucket. Grate/strainer weight loading classification is based on ASME A112.6.3. Dimensions are nominal. Full grate free area shall be a minimum of 1.5 times the free area of the outlet pipe size. [Provide drain with trap primer connection, trap primer, and connection piping.]

****
NOTE: FS-1 (square) and FS-2 (round) intended for use in unfinished spaces such as below sterilizer locations, or concealed within an enclosure.
****

a. FS-1: 300 mm 12 inch square top, 250 mm 10 inch deep [with] [full] [3/4] [1/2] [light-duty nickel bronze] [less] [grate].

b. FS-2: 300 mm 12 inch diameter top, 250 mm 10 inch deep [with] [full]

[3/4] [1/2] [light-duty nickel bronze] [less] [grate].

****
NOTE: FS-3 (square) and FS-4 (round) intended for use in finished exposed locations except kitchens.
****

c. FS-3: 300 mm 12 inch square top, 250 mm 10 inch deep [with] [full] [3/4] [1/2] [light-duty acid-resisting] [less] [grate].

d. FS-4: 300 mm 12 inch diameter top, 250 mm 10 inch deep [with] [full] [3/4] [1/2] [light-duty acid-resisting] [less] [grate].

****
NOTE: FS-5 intended for use in kitchens.
****

e. FS-5: 300 mm 12 inch square top, 250 mm 10 inch deep with stainless steel rim and [full] [3/4] [1/2] [light-duty stainless steel] [less] [grate].

2.12.4 Roof Drains and Expansion Joints

Roof drains shall conform to ASME A112.6.4, with dome and integral flange, and shall have a device for making a watertight connection between roofing and flashing. Provide roof drains designated as secondary (emergency) overflow drains with 50 mm 2 inch high dam. The whole assembly shall be [galvanized] heavy pattern cast iron including the dome strainer. Provide drain with a gravel stop. On roofs other than concrete construction, drains shall be complete with underdeck clamp, sump receiver, and an extension for the insulation thickness where applicable. Provide a clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane when present. Strainer openings shall have a combined area equal to twice that of the drain outlet. The outlet shall be equipped to make a proper connection to threaded pipe of the same size as the rain leader. An expansion joint of proper size to receive the rain leader shall be provided. The expansion joint shall consist of a heavy cast-iron housing, brass or bronze sleeve, brass or bronze fastening bolts and nuts, and gaskets or packing. The sleeve shall have a nominal thickness of not less than 3.416 mm 0.134 inch. Gaskets and packing shall be close-cell neoprene, O-ring packing shall be close-cell neoprene of 70 durometer. Packing shall be held in place by a packing gland secured with bolts.

****
NOTE: RD-1 intended for use as primary roof drain. These can also be used at bottom of usually non-accessible areaways. See AD-1 for accessible areaways.
****

a. RD-1: 400 to 500 mm 16 to 19 inch diameter flashing clamp, 280 to 350 mm 11 to 14 inch diameter by 125 mm 5 inch high dome strainer.

****
NOTE: RD-2 intended for use as secondary (emergency) roof drain.
****

b. RD-2: 400 to 500 mm 16 to 19 inch diameter flashing clamp, 280 to 350 mm 11 to 14 inch diameter by 125 mm 5 inch high dome strainer. Provide minimum 50 mm 2 inch high internal or external water dam.

2.12.5 Sight Drains

a. Provide sight drains with coated [galvanized] cast iron bodies, double drainage pattern for embedding in the floor construction, and seepage pan having weep holes or channels for drainage to the drainpipe. The grate/strainer shall be adjustable to floor thickness. Provide an integral clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane when required. Provide with threaded outlet connection. Between the outlet and waste pipe, a neoprene rubber gasket conforming to ASTM C564 may be installed, provided that the drain is specifically designed for the rubber gasket compression type joint. Floor and shower drains shall conform to ASME A112.6.3. Grate/strainer weight loading classification is based on ASME A112.6.3. Dimensions are nominal. [Provide drain with trap primer connection, trap primer, and connection piping.]

b. SD-1: 250 mm 10 inch diameter invertible flashing collar, 50 mm 2 inch deep body, and minimum 150 mm 6 inch [square] [diameter] removable, secured, light-duty nickel bronze strainer with minimum free area of 1.5 times free area of outlet pipe size with funnel extension. Provide minimum funnel dimensions as follows:

(1) Height of funnel 95 mm 3-3/4 inches.

(2) Diameter of lower portion of funnel 50 mm 2 inches.

(3) Diameter of upper portion of funnel 100 mm 4 inches.

2.12.6 Backwater Valves

Backwater valves shall be either separate from the floor drain or a combination floor drain, P-trap, and backwater valve, as shown. Valves shall have cast-iron bodies with cleanouts large enough to permit removal of interior parts. Valves shall be of the flap type, hinged or pivoted, with revolving disks. Hinge pivots, disks, and seats shall be nonferrous metal. Disks shall be slightly open in a no-flow no-backwater condition. Cleanouts shall extend to finished floor and be fitted with threaded countersunk plugs.

2.13 CLEANOUTS

a. Provide cleanouts with coated cast-iron bodies (unless otherwise noted) with extra-heavy, threaded, tapered, brass plug with solid hexagonal nut and American Standard pipe threads. Provide flashing collars and clamps for cleanout bodies being installed in floors with finishes installed over waterproofing. Cleanouts on piping completely accessible from within pipe chases do not require covers. Cleanouts in exposed piping in equipment rooms do not require covers.

b. Provide interior floor-mounted cleanouts with a two-piece, threaded, adjustable housing. Provide top and cover based on floor finish:

(1) Resilient tile and sheet finish: Round flange top with scoriated cover.

(2) Ceramic tile finish: Square flange top with scoriated cover.

(3) Poured finish: Round, wide-flange top with scoriated cover.

(4) Carpet finish: Round top with standard top tapped for carpet-marker bolt.

(5) Terrazzo finish: Round top with recessed-for-terrazzo cover.

(6) Quarry tile finish: Square, heavy-duty top with heavy-duty scoriated cover.

(7) Concrete finish (unfinished areas): Heavy, round frame; satin-bronze, scoriated tractor top, ANSI heavy duty load class.

****

NOTE: Isolation cleanouts are used in floating floors.

****

[c. Provide isolation cleanouts with a lower and an upper flashing collar, flashing clamps with seepage openings, and adjustable ferrule with 100 mm 4 inch diameter bronze top. Ferrule shall be tapped for cleanout plug. Seal ferrule to lower clamping collar with press-fit neoprene gasket. Seal cleanout plug with neoprene gasket.]

2.14 TRAPS

2.14.1 Fixture Traps

Unless otherwise specified, traps shall be copper-alloy adjustable tube type with slip joint inlet and swivel. Traps shall be [without] [with] a cleanout. [Provide traps with removable access panels for easy clean-out at sinks and lavatories.] Tubes shall be copper alloy with walls not less than 0.813 mm 0.032 inch thick within commercial tolerances, except on the outside of bends where the thickness may be reduced slightly in manufacture by usual commercial methods. Inlets shall have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints shall be below the discharge level and shall be of metal-to-metal type as required for the application. Nuts shall have flats for wrench grip. Outlets shall have internal pipe thread, except that when required for the application, the outlets shall have sockets for solder-joint connections. The depth of the water seal shall be not less than 50 mm 2 inches and not more than 100 mm 4 inches. The interior diameter shall be not more than 3.2 mm 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. A copper alloy "P" trap assembly consisting of an adjustable "P" trap and threaded trap wall nipple with cast brass wall flange shall be provided for lavatories. The assembly shall be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.14.2 Drain Traps

Unless otherwise specified, traps shall be cast iron, one piece pattern, deep seal with depth of water seal of 100 mm 4 inches. The interior diameter shall be not more than 3.2 mm 1/8 inch over or under the nominal size, and interior surfaces shall be reasonably smooth throughout. The trap assembly shall be a standard manufactured unit. Traps for drains

located in fan and plenum housings shall maintain seal against the static pressure.

[2.15 TRAP PRIMER ASSEMBLIES

Provide fully automatic trap primer assemblies, factory assembled and prepiped and including 19 mm 3/4 inch NPT female inlet, bronze body 19 mm 3/4 inch female NPT ball valve, 19 mm 3/4 inch water hammer arrester, ASSE 1001 atmospheric vacuum breaker, and ASTM B88 19 mm 3/4 inch Type L copper tubing distribution manifold. Distribution manifold shall be calibrated to provide equal water distribution to each trap. Provide minimum supply of 60 mL 2 ounces of water to each trap. Provide manifold with 16 mm x 15 mm 5/8 inch x 1/2 inch compression fitting outlets. All solder joints shall be made with lead free solder. Provide electronic assembly tested and certified per UL 73 and including circuit breaker, 5 second dwell function, manual override, 24 hour geared timer, and solenoid valve. Provide single point water supply and power supply connections. Components shall be installed in a NEMA 250 Type 1 [surface mounted] [recessed] cabinet.

]2.16 INTERCEPTORS

****
NOTE: Concrete pit must be detailed on structural drawings for exterior interceptor pits.
****

2.16.1 Grease Interceptor

Grease interceptor of the size indicated shall be of reinforced concrete, [or precast concrete construction] [or equivalent capacity commercially available steel grease interceptor] with removable three-section, 9.5 mm 3/8 inch checker-plate cover, and shall be installed outside the building. Steel grease interceptor shall be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Interceptors shall be tested and rated in accordance with PDI G 101. Concrete shall have 21 MPa 3,000 psi minimum compressive strength at 28 days. Provide flow control fitting.

2.16.2 Oil Interceptor

Cast iron or welded steel, coated inside and outside with white acid resistant epoxy, with internal air relief bypass, bronze cleanout plug, double wall trap seal, removable combination pressure equalizing and flow diffusing baffle and sediment bucket, horizontal baffle, adjustable oil draw-off and vent connections on either side, gas and watertight gasketed nonskid cover, and flow control fitting.

2.17 WATER HEATERS

****
NOTE: Coordinate with the HVAC engineer the availability of heating sources and control air in order to make proper selection of bracketed choices.

Show locations of water heaters on the drawings. Also show the type, capacity, etc. of each water heater on the drawings.

Except for gas-fired water heaters, water temperatures in excess of 60 degrees C (140 degrees F) should be obtained by using a booster heater in series with a primary heater. When using a gas-fired water heater, provide thermostatic, pressure-balanced, or combination thermostatic and pressure-balanced type mixing valves to obtain water temperatures below 60 degrees C (140 degrees F).

Ensure that efficiencies are equal to or greater than the latest "recommended" values currently released by the Department of Energy Federal Energy Management Program (FEMP). The latest values can be found on FEMP's Internet site: http://www1.eere.energy.gov/temp.

Select expansion tank based on incoming water pressure, water heater volume and temperature rise of water. Consult expansion tank manufacturer for sizing recommendations. Show the expansion tank size and acceptance volume on the drawings.

****

Provide water heaters with replaceable anodes. Each primary water heater shall have controls with an adjustable range that includes 32 to 71 degrees C 90 to 160 degrees F. Each gas-fired water heater and booster water heater shall have controls with an adjustable range that includes 49 to 82 degrees C 120 to 180 degrees F. Hot water systems utilizing recirculation systems shall be tied into building off-hour controls. The thermal efficiencies and standby heat losses shall conform to or exceed the requirements of ASHRAE 90.1 - SI ASHRAE 90.1 - IP, or 10 CFR 430 whichever is the most stringent for each type of water heater specified. The only exception is that storage water heaters and hot water storage tanks having more than 2000 liters 500 gallons storage capacity need not meet the standard loss requirement if the tank surface area is insulated to R-12.5 and if a standing light is not used. Plastic materials, polyetherimide (PEI) and polyethersulfone (PES), are forbidden to be used for vent piping of combustion gases. A factory pre-charged expansion tank shall be installed on the cold water supply to each water heater. Expansion tanks shall be specifically designed for use on potable water systems and shall be rated for 93 degrees C 200 degrees F water temperature and 1034 kPa 150 psi working pressure.

2.17.1 Performance of Water Heating Equipment

Standard rating condition terms are as follows:

EF = Energy factor, overall efficiency.

ET = Thermal efficiency with 21 degrees C 70 degrees F delta T.

EC = Combustion efficiency, 100 percent - flue loss when smoke = 0 (trace is permitted).

SL = Standby loss in W/0.093 sq. m. W/sq. ft. based on 27 degrees C 80 degrees F delta T, or in percent per hour based on nominal 38 degrees C 90 degrees F delta T.

HL = Heat loss of tank surface area.

V = Storage volume in liters

2.17.1.1 Storage Water Heaters

a. Electric:

(1) Storage capacity of 454 liters 120 gallons or less, and input rating of 12 kW or less: minimum energy factor (EF) shall be 0.93-0.00132V per 10 CFR 430.

(2) Storage capacity of more than 454 liters 120 gallons or input rating more than 12 kW: maximum SL shall be 0.2931(20+35 V), W 20+35 V, Btu/h per ANSI Z21.10.3/CSA 4.3.

b. Gas:

(1) Storage capacity of 379 liters 100 gallons or less, and input rating of 21980 W 75,000 Btu/h or less: minimum EF shall be 0.62-0.0019V per 10 CFR 430.

(2) Storage capacity of more than 379 liters 100 gallons or input rating more than 21980 W 75,000 Btu/h: Et shall be 80 percent; maximum SL shall be 0.2931(Q/800+110 V), W Q/800+110 V, Btu/h per ANSI Z21.10.3/CSA 4.3.

c. Oil:

(1) Storage capacity of 189 liters 50 gallons or less and input rating of 30773 W 105,000 Btu/h or less: minimum EF shall be 0.59-0.0019V per 10 CFR 430.

(2) Storage capacity of more than 189 liters 50 gallons or input rating more than 30773 W 105,000 Btu/h: Et shall be 78 percent; maximum SL shall be 0.2931(Q/800+110 V), W Q/800+110 V, Btu/h per ANSI Z21.10.3/CSA 4.3.

2.17.1.2 Unfired Hot Water Storage

All volumes and inputs: tank surface shall be thermally insulated to R12.5 per ASHRAE 90.1 - SI ASHRAE 90.1 - IP.

2.17.1.3 Instantaneous Water Heater

a. Gas:

(1) Input rating of 14655 to 58620 W 50,000 to 200,000 Btu/h: minimum EF shall be 0.62-0.0019V per 10 CFR 430.

(2) Input rating of more than 58620 W 200,000 Btu/h: Et shall be 80 percent per ANSI Z21.10.3/CSA 4.3.

b. Oil:

(1) Input rating of 61551 W 210,000 Btu/h or less: minimum EF shall be 0.59-0.0019V per 10 CFR 430.

(2) Input rating of more than 61551 W 210,000 Btu/h: Et shall be 80 percent per ANSI Z21.10.3/CSA 4.3.

2.17.2 Automatic Storage Type

****
NOTE: Gas-fired water heaters are more efficient in source energy use than electric resistance water heaters. Avoid use of electric type unless they are shown through calculations to be life cycle cost effective. Heat pump water heaters can use waste heat from air conditioners and heat pumps to produce hot water in an efficient manner. Consider this when waste heat is available.
****

Provide heaters complete with [control system,] [control system, temperature gauge, and pressure gauge,] and ASME rated combination pressure and temperature relief valve.

2.17.2.1 Oil-Fired Type

Provide oil-fired type water heaters conforming to UL 732.

2.17.2.2 Gas-Fired Type

Provide gas-fired water heaters conforming to ANSI Z21.10.1/CSA 4.1 when input is 22 KW 75,000 BTU per hour or less, or ANSI Z21.10.3/CSA 4.3 for heaters with input greater than 22 KW 75,000 BTU per hour.

2.17.2.3 Electric Type

Provide electric type water heaters conforming to UL 174 with dual heating elements. Each element shall be 4.5 KW. The elements shall be wired for non-simultaneous operation so that only one element can operate at a time.

2.17.2.4 Indirect Heater Type

****
NOTE: The titles of the sections covering the applicable systems will be inserted in the blanks.

Cast-iron heads will be used in steam-to-steam or non fired boiler application. Bronze heads will be used in steam-to-water application. Carbon steel heads will be used in water-to-water applications. For most applications, copper coils will be acceptable. Copper-nickel coils will be used with high pressure steam, 1.034 MPa (150 psi) or above, high temperature water, or salty water conditions.

Single wall type exchangers may be allowed if the requirements in the plumbing code are satisfied (one requirement is that the heat transfer medium is potable or recognized as safe).

Steam and high temperature hot water HTHW systems are NOT normally used in Air Force and almost never used in Navy jobs. When using these systems keep all steam and HTHW piping in the mechanical rooms and do not route the distribution piping through

occupied portions of the facilities.
****

Steam and high temperature hot water (HTHW) heaters with storage system shall be the assembled product of one manufacturer, and be ASME tested and "U" stamped to code requirements under ASME BPVC SEC VIII D1. The storage tank shall be as specified in paragraph HOT-WATER STORAGE TANKS. The heat exchanger shall be double wall type that separates the potable water from the heat transfer medium with a space vented to the atmosphere in accordance with ICC IPC.

a. HTHW Energy Source: The heater element shall have a working pressure of 2758 kPa 400 psi with water at a temperature of 204 degrees C 400 degrees F. The heating surface shall be based on 0.093 square meter 1 square foot of heating surface to heat 76 liters 20 gallons or more of water in 1 hour from 4 to 82 degrees C 40 to 180 degrees F using hot water at a temperature of 178 degrees C 350 degrees F. Carbon steel heads shall be used. Tubing shall conform to ASTM B111/B111M, Copper Alloy No. 706 (90-10 copper-nickel). Heating elements shall withstand an internal hydrostatic pressure of 4137 kPa 600 psi for not less than 15 seconds without leaking or any evidence of damage.

b. Steam Energy Source: The heater element shall have a working pressure of 1034 kPa 150 psi with steam at a temperature of 185 degrees C 365 degrees F. The heating surface shall be based on 0.093 square meter 1 square foot of heating surface to heat 76 liters 20 gallons or more of water in 1 hour from 4 to 82 degrees C 40 to 180 degrees F using steam at atmospheric pressure. [Cast iron] [bronze] heads shall be used. Tubing shall be light-drawn copper tubing conforming to ASTM B75M ASTM B75. Heating elements shall withstand an internal hydrostatic pressure of 1551 kPa 225 psi for not less than 15 seconds without leaking or any evidence of damage.

2.17.3 Instantaneous Water Heater

Heater shall be crossflow design with service water in the coil and [steam] [hot water] in the shell. An integral internal controller shall be provided, anticipating a change in demand so that the final temperature can be maintained under all normal load conditions when used in conjunction with [pneumatic control system] [pilot-operated temperature control system]. Normal load conditions shall be as specified by the manufacturer for the heater. Unit shall be manufactured in accordance with ASME BPVC SEC VIII D1, and shall be certified for 1.03 MPa 150 psi working pressure in the shell and 1.03 MPa 150 psi working pressure in the coils. Shell shall be carbon steel with copper lining. Heads shall be [cast iron] [bronze] [carbon steel plate with copper lining]. Coils shall be [copper] [copper-nickel]. Shell shall have metal sheathed fiberglass insulation, combination pressure and temperature relief valve, and thermometer. Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.17.4 Electric Instantaneous Water Heaters (Tankless)

UL 499 and UL listed flow switch activated, tankless electric instantaneous water heater for wall mounting below sink or lavatory.

2.17.5 Relief Valves

Water heaters and hot water storage tanks shall have a combination pressure

and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve shall have adequate capacity to prevent excessive pressure buildup in the system when the system is operating at the maximum rate of heat input. The temperature element of a P&T relief valve shall have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves shall be rated according to ANSI Z21.22/CSA 4.4. Relief valves for systems where the maximum rate of heat input is less than 59 kW 200,000 Btuh shall have 20 mm 3/4 inch minimum inlets, and 20 mm 3/4 inch outlets. Relief valves for systems where the maximum rate of heat input is greater than 59 kW 200,000 Btuh shall have 25 mm 1 inch minimum inlets, and 25 mm 1 inch outlets. The discharge pipe from the relief valve shall be the size of the valve outlet.

2.18 HOT-WATER STORAGE TANKS

Hot-water storage tanks shall be constructed by one manufacturer, ASME stamped for the working pressure, and shall have the National Board (ASME) registration. The tank shall be cement-lined or glass-lined steel type in accordance with AWWA D100. The heat loss shall conform to TABLE III as determined by the requirements of ASHRAE 90.1 - SI ASHRAE 90.1 - IP. Each tank shall be equipped with a thermometer, conforming to ASTM E1, Type I, Class 3, Range C, style and form as required for the installation, and with 175 mm 7 inch scale. Thermometer shall have a separable socket suitable for a 19 mm 3/4 inch tapped opening. Tanks shall be equipped with a pressure gauge 155 mm 6 inch minimum diameter face. Insulation shall be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Storage tank capacity shall be as shown.

2.19 PUMPS

2.19.1 Sump Pumps

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NOTE: Designer will indicate location, sizes, horsepower, and capacities of equipment on the drawings. Provide duplex pumps, if discharge capacity is greater than 1.6 liters per second (25 gpm) and total head is at least 6 m (20 feet). Delete "totally enclosed and fan cooled" when not required.
****

Provide sump pumps of the automatic, electric motor-driven, submerged type, complete with necessary control equipment and with a split or solid cast-iron or steel cover plate. The pumps shall be direct-connected by an approved flexible coupling to a vertical electric motor having a continuous oiling device or packed bearings sealed against dirt and moisture. Motors shall be totally enclosed, fan-cooled of sizes as indicated and shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 4 enclosure. Each pump shall be fitted with a high-grade thrust bearing mounted above the floor. Each shaft shall have an alignment bearing at each end, and the suction inlet shall be between 75 and 150 mm 3 and 6 inches above the sump bottom. The suction side of each pump shall have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type 4 enclosure, shall start and stop each motor at predetermined water levels. Duplex pumps shall be equipped with an automatic alternator to change the lead operation from one pump to the other, and for starting the second pump if the flow exceeds the

capacity of the first pump. The discharge line from each pump shall be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.19.2 Hydraulic Elevator Sump Pumps

Provide sump pump and control system capable of pumping water while containing oil. The system shall function automatically and shall provide for an alarm in the event of the presence of oil in the sump, high liquid in the sump, or high amps or a locked rotor condition. An alarm that sounds only in the event of a high liquid condition shall not be acceptable. Provide submersible type pump. Pump shall be approved to UL 778 standards and shall include thermal and overload protection. Provide motor capable of operating continuously or intermittently. Provide motor housing constructed of 304 stainless steel, and mechanical seals housed in a separate oil-filled compartment. Provide controls approved to UL 508 standards and housed in a NEMA 4X enclosure with stainless steel hinged hardware. The controls shall include dual relays with variable sensitivity settings, magnetic contactor with separate over-current relay, self-cleaning stainless steel sensor probe, high decibel warning horn with illuminated red light and alarm silencing switch, dual floats, clearly marked terminal board and remote monitoring contact. All cables between the pump and control unit shall be a minimum of 4.9 meters 16 feet long and the cable and plug from the control unit shall be a minimum of 2.5 meters 8 feet long. The control unit, pump, floats, and sensor probe shall be factory assembled as a complete, ready to use system and shall be tested and approved by a nationally recognized testing laboratory such as ENTELA.

2.19.3 Circulating Pumps

Provide electrically driven, single-stage, centrifugal domestic hot water circulating pumps with mechanical seals, suitable for the intended service. Revolutions per minute shall not exceed 3000. Pump and motor shall be [integrally mounted on a cast-iron or steel subbase,] [close-coupled with an overhung impeller,] [or] [supported by the piping on which it is installed]. The shaft shall be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze. Motor shall be totally enclosed, fan-cooled and shall have sufficient wattage (horsepower) horsepower for the service required. Each pump motor shall be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover. Pump motors smaller than 746 watts 1 horsepower shall have integral thermal overload protection in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Guards shall shield exposed moving parts.

2.19.4 Booster Pumps

2.19.4.1 Centrifugal Pumps

Provide horizontal split-case centrifugal-type booster pumps. Revolutions per minute shall not exceed 1800. Pumps shall have a casing of close-grained iron or steel with smooth water passages. A gasket shall be provided between the upper and lower halves of the casing. Suction and discharge connections shall be flanged. Impellers shall be nonoverloading, bronze, balanced to eliminate vibration, and shall be keyed to corrosion-resisting steel shafts. The casings shall be fitted with bronze wearing or sealing rings. Bearings shall be cartridge type, enabling the entire rotating element to be removed without disturbing alignment or exposing the bearings to dirt, water, and other foreign matter. Pumps

shall be provided with mechanical seals. Seal boxes shall be machined in the pump casing and at both sides of the pump, and shall be of sufficient depth to include a conventional bronze seal ring and rows of shaft packing. Bedplates shall be close-grain cast iron or steel with ribs and lugs, complete with foundation bolts, and shall have a drip lip with drain hole. Each pump shall be tested at the manufacturer's plant for operating characteristics at the rated capacity and under specified operating conditions. Test curves shall be furnished showing capacity in liters per second gpm, head in meters feet, efficiency, brake wattage horsepower, and operation in parallel with similar pumps. Multiple pump installations shall have pump characteristics compatible for operation in parallel with similar pumps. The electric motor shall be sized for non-overload when operating at any point along the characteristic curve of the pump. Guards shall shield exposed belts and moving parts.

2.19.4.2 Controls

Provide each pump motor with enclosed across-the-line-type magnetic controller complete in a NEMA 250 Type 1 enclosure with three position, "HAND-OFF-AUTOMATIC," selector switch in cover. Pumps shall be automatically started and stopped by float or pressure switches. The pumps shall start and stop at the levels and pressures indicated. A multiposition sequence selector switch shall be provided so that any two pumps may be operated simultaneously keeping a third pump as a standby.

2.19.5 Flexible Connectors

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NOTE: Flexible connectors should be provided for the suction and discharge of each centrifugal pump only as a solution to alignment problems to accommodate retrofits and/or for fluid media temperatures in access of 82 degrees C (180 degrees F).

****

Provide flexible connectors at the suction and discharge of each pump that is 746 watts 1 horsepower or larger. Connectors shall be constructed of neoprene, rubber, or braided bronze, with Class 150 standard flanges. Flexible connectors shall be line size and suitable for the pressure and temperature of the intended service.

2.19.6 Sewage Pumps

Provide duplex type with automatic controls to alternate the operation from one pump to the other pump and to start the second pump in the event the first pump cannot handle the incoming flow. Provide high water alarm and check valve.

2.20 WATER PRESSURE BOOSTER SYSTEM

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NOTE: One of the following systems will be used to boost the water pressure to the value required for service within the building. Indicate location, sizes, horsepower, and capacities of equipment on drawings. Provide duplex pumps, if discharge capacity is greater than 1.6 liter per second (25 gpm) and total head is at least 59.78 kPa (20 feet).

****

[2.20.1 Constant Speed Pumping System

Provide constant speed pumping system with pressure-regulating valves employing one lead pump for low flows, and one or more lag pumps for higher flows. Pressure-regulating valves shall be provided with nonslam check feature. Provide factory prepiped and prewired assembly mounted on a steel frame, complete with pumps, motors, automatic controls, and ASME code constructed hydro-pneumatic tank. Current sensing relays shall provide staging of the pumps. The pumps shall be protected from thermal buildup, when running at no-flow, by a common thermal relief valve. Pressure gauges shall be mounted on the suction and discharge headers. The control panel shall bear the UL listing label for industrial control panels and shall be in a NEMA 250, Type 1 enclosure. The control panel shall include the following: no-flow shutdown; 7-day time clock; audiovisual alarm; external resets; manual alternation; magnetic motor controllers; time delays; transformer; current relays; "HAND-OFF-AUTOMATIC" switches for each pump; minimum run timers; low suction pressure cutout; and indicating lights for power on, individual motor overload, and low suction pressure. The control circuit shall be interlocked so that the failure of any controller shall energize the succeeding controller. Provide an ASME code constructed hydro-pneumatic tank stamped for 862 kPa 125 psi water working pressure. The tank shall have a flexible diaphragm made of material conforming to FDA requirements for use with potable water and shall be factory precharged to meet required system pressure.

][2.20.2 Variable Speed Pumping System

Variable speed pumping system shall provide system pressure by varying speed and number of operating pumps. The factory prepiped and prewired assembly shall be mounted on a steel frame complete with pumps, variable speed drives, motors, automatic controls, and ASME code constructed hydro-pneumatic tank. The variable speed drives shall be the oil-filled type capable of power transmission throughout their complete speed range without vibration, noise, or shock loading. Each variable speed drive shall be run-tested by the manufacturer for rated performance, and the manufacturer shall furnish written performance certification. System shall have suppressors to prevent noise transmission over electric feed lines. Required electrical control circuitry and system function sensors shall be supplied by the variable speed drive manufacturer. The primary power controls and magnetic motor controllers shall be installed in [the controls supplied by the drive manufacturer] [the motor control center]. The sensors shall be located in the system to control drive speed as a function of [constant pump discharge pressure] [constant system pressure at location indicated]. Connection between the sensors and the variable speed drive controls shall be accomplished with [hydraulic sensing lines] [copper wiring] [telemetry]. Controls shall be in NEMA 250, Type 1 enclosures. Provide an ASME code constructed hydro-pneumatic tank stamped for 862 kPa 125 psi water working pressure. The tank shall have a flexible diaphragm made of material conforming to FDA requirements for use with potable water and shall be factory precharged to meet required system pressure.

]2.21 DOMESTIC WATER SERVICE METER

Cold water meters 50 mm 2 inches and smaller shall be positive displacement type conforming to AWWA C700. Cold water meters 65 mm 2-1/2 inches and larger shall be turbine type conforming to AWWA C701. Meter register may be round or straight reading type, [indicating [_____]] [as provided by the

local utility]. Meter shall be provided with a pulse generator, remote readout register and all necessary wiring and accessories.

2.22 COPPER-SILVER IONIZATION SYSTEM

a. Provide a complete copper-silver ionization system consisting of a controller, electrode cell(s), and flow meter.

b. Provide a microprocessor-based controller that automatically controls the rate of copper and silver ion release. Controller must be able to generate a minimum concentration of 0.25 mg/L 25 ug/L copper on a continuous basis. Controller shall perform under all types of water conditions without limiting its current due to lack of voltage. Controller shall operate primarily in proportional copper and silver ion level control mode to prevent over or under ionization, and shall be capable of operating in secondary control modes, to include continuous, timer, and flow switch. Controller shall incorporate anti-scaling features.

c. Provide on-board and remote alarm connection capabilities. Provide auxiliary contacts for remote monitoring capability. Controller shall conform to UL 508 for Industrial Control Panels.

d. Provide electrode cell(s) incorporating reduced scaling features. Housing shall be CPVC, epoxy coated aluminum, or Schedule 40 stainless steel. Provide with electrical quick connections. Provide sacrificial electrodes of an extruded alloy of 99.99 percent pure copper and 99.99 percent pure medical grade silver, with minimum ratio of 30 percent silver to 70 percent copper.

e. Provide a flow meter with a transmitter that displays the flow rate and total water usage. Provide clamp on transducers (non pipe invasive) with a flow response time of 0.3 seconds and flow sensitivity of 0.0003 m/s 0.001 fps.

f. Submit EPA registration for Copper-Silver Ionization as pesticide product or if the company was selling the product as a device, then the company needs only to provide proof (EPA product label) that the registration application was submitted by March 2009 to the EPA.

g. Submit written NSF certification for Copper-Silver Ionization that the system (or components in contact with potable water) are certified.

2.23 ELECTRICAL WORK

****

NOTE:

1. Show the electrical characteristics, motor starter type(s), enclosure type, and maximum rpm in the equipment schedules on the drawings.

2. Where reduced-voltage motor starters are recommended by the manufacturer or required otherwise, specify and coordinate the type(s) required in Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM. Reduced-voltage starting is required when full voltage starting will interfere with other electrical equipment and circuits and when

recommended by the manufacturer.

3. Use the bracketed item specifying high efficiency single-phase motors for applications where the use of high efficiency motors is determined to be cost effective.

4. Use the second bracketed item where polyphase motors are part of an assembly, and the use of premium efficiency motors is cost-effective. Premium efficiency motors are required by Section 26 20 00 for individual motors that are not part of a packaged system.

****

a. Provide electrical motor driven equipment specified complete with motors, motor starters, and controls as specified herein and in Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM. Provide internal wiring for components of packaged equipment as an integral part of the equipment. Provide [high efficiency type,] single-phase, fractional-horsepower alternating-current motors, including motors that are part of a system, corresponding to the applications in accordance with NEMA MG 11. [In addition to the requirements of Section 26 20 00, INTERIOR DISTRIBUTION SYSTEM, provide polyphase, squirrel-cage medium induction motors with continuous ratings, including motors that are part of a system, that meet the efficiency ratings for premium efficiency motors in accordance with NEMA MG 1.] Provide motors in accordance with NEMA MG 1 and of sufficient size to drive the load at the specified capacity without exceeding the nameplate rating of the motor.

b. Motors shall be rated for continuous duty with the enclosure specified. Motor duty requirements shall allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque shall be capable of accelerating the connected load within 20 seconds with 80 percent of the rated voltage maintained at motor terminals during one starting period. Motor bearings shall be fitted with grease supply fittings and grease relief to outside of the enclosure.

c. Controllers and contactors shall have auxiliary contacts for use with the controls provided. Manual or automatic control and protective or signal devices required for the operation specified and any control wiring required for controls and devices specified, but not shown, shall be provided. For packaged equipment, the manufacturer shall provide controllers, including the required monitors and timed restart.

d. Power wiring and conduit for field installed equipment shall be provided under and conform to the requirements of Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

2.24 FACTORY PAINTING

a. Manufacturer's standard factory painting systems may be provided subject to certification that the factory painting system applied will withstand 125 hours in a salt-spray fog test, except that equipment located outdoors shall withstand 500 hours in a salt-spray fog test. Salt-spray fog test shall be in accordance with ASTM B117, and for that test the acceptance criteria shall be as follows: immediately after completion of the test, the paint shall show no signs of blistering,

wrinkling, or cracking, and no loss of adhesion; and the specimen shall show no signs of rust creepage beyond 3 mm 1/8 inch on either side of the scratch mark.

b. The film thickness of the factory painting system applied on the equipment shall not be less than the film thickness used on the test specimen. If manufacturer's standard factory painting system is being proposed for use on surfaces subject to temperatures above 50 degrees C 120 degrees F, the factory painting system shall be designed for the temperature service.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

3.2 GENERAL INSTALLATION REQUIREMENTS

a. Piping located in air plenums shall conform to NFPA 90A requirements. [Plastic pipe shall not be installed in air plenums.] Piping located in shafts that constitute air ducts or that enclose air ducts shall be noncombustible in accordance with NFPA 90A. [Installation of plastic pipe where in compliance with NFPA may be installed in accordance with PPFA Fire Man.] The plumbing system shall be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Piping shall be concealed wherever possible. Under no circumstances reduce pipe size on Contract Documents without written consent of Contracting Officer. Extend water and drainage piping 1525 mm 5 feet outside the building, unless otherwise indicated. A [OS&Y valve] [full port ball valve] and drain shall be installed on the water service line inside the building approximately 150 mm 6 inches above the floor from point of entry. Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm 12 inches below the average local frost depth or 450 mm 18 inches below finish grade whichever is greater. If trenches are closed or the pipes are otherwise covered before being connected to the service lines, the location of the end of each plumbing utility shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

b. Provide piping to fixtures, outlets, and equipment requiring drainage, vent, and water utilities. The hot-water and cold-water piping system shall be arranged and installed to permit draining. The supply line to each item of equipment or fixture, except faucets, flush valves, or other control valves which are supplied with integral stops, shall be equipped with a shutoff valve to enable isolation of the item for repair and maintenance without interfering with operation of other equipment or fixtures. Supply piping to fixtures, faucets, hydrants, shower heads, and flushing devices shall be anchored to prevent movement.

c. The work shall be carefully laid out in advance, and unnecessary cutting of construction shall be avoided. Damage to building, piping, wiring, or equipment as a result of cutting shall be repaired by

mechanics skilled in the trade involved.

d. Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water, chemicals, and mechanical injury. Upon completion of the work, the fixtures, materials, and equipment shall be thoroughly cleaned, adjusted, and operated. Safety guards shall be provided for exposed rotating equipment.

e. Branch sizes to individual fixtures shall be as scheduled. Consult manufacturer's data, Architectural drawings, and/or Plumbing drawings of rooms containing equipment and plumbing fixtures prior to roughing in piping. Stub piping through wall directly behind equipment item, or fixture being served. Connect equipment furnished by Owner or other divisions of the specification in accordance with this section.

3.3 DOMESTIC WATER PIPING SYSTEMS

3.3.1 General

Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Branch pipes from service lines may be taken from top, bottom, or side of main, using crossover fittings required by structural or installation conditions. Supply pipes, valves, and fittings shall be kept a sufficient distance from other work and other services to permit not less than 13 mm 1/2 inch between finished covering on the different services. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings.

3.3.2 Service Entrance

Provide service entrance installation through [below grade exterior wall with water-stop pipe sleeves.] [slab on grade with reaction anchor at buried elbow where water service pipe turns up below floor. Terminate end of exterior piping material with flange connection and tie flange back to buried elbow with tie rods of same diameter as flange bolts. Provide minimum of one tie rod for each two flange bolt holes. Provide permanent corrosion protection for below-grade tie rods.]

3.3.3 Pipe Drains

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NOTE: Designer will indicate location of pipe drains on the drawings.
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Pipe drains shall consist of 19 mm 3/4 inch hose bibb with renewable seat and [gate] [full port ball] [ball] valve ahead of hose bibb. At other low points, 19 mm 3/4 inch brass plugs or caps shall be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.3.4 Valves

Provide manual isolation valves at base of risers, on branch runouts from piping mains, on each branch serving a rest room, on each branch serving an equipment item, and on each branch to hose bibb or wall hydrant. [Wire isolation valves on emergency fixture supply open and tag "Do Not Close".] Balance hot water circulation system.

3.3.5 Expansion and Contraction of Piping

Allowance shall be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser shall have expansion loops or other provisions such as offsets, changes in direction, or manufactured expansion fittings. Risers shall be securely anchored to force expansion to loops. Branch connections from risers shall be made with ample swing or offset to avoid undue strain on fittings or short pipe lengths. Horizontal runs of pipe over 15 m 50 feet in length shall be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility shall be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility shall be provided by installing one or more turns in the line so that piping will spring enough to allow for expansion without straining. If mechanical grooved pipe coupling systems are provided, the deviation from design requirements for expansion and contraction may be allowed pending approval of Contracting Officer.

3.3.6 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in waterlines 100 mm 4 inches in diameter or larger shall be provided with thrust blocks, to prevent movement. Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2.5 sand, 5 gravel; and having a compressive strength of not less than 14 MPa 2000 psi after 28 days. Blocking shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

3.3.7 Commercial-Type Water Hammer Arresters

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NOTE: Designer will indicate location, quantity and size of commercial-type water hammer arresters on the drawings. Commercial-type water hammer arresters will be sized and located in accordance with PDI WH 201. Piping serving equipment having quick-closing valves shall have suitably sized arresters. The ICC International Plumbing Code defines a quick-closing valve and the Codes 1997 Commentary provides examples of what are and are not considered quick-closing valves. PDI-WH 201 also defines quick valve closure. Review of these

documents will help the designer provide the proper number of arresters.

For pressures of 450 kPa (65 psi) or less, commercial water hammer arresters may be reduced by the designer in number and size, if the system does not contain quick-acting valves. Water pressure regulating or reducing valves may be provided in lieu of commercial-type water hammer arresters, if local use has provided satisfactory performance. When required, install arresters as close as possible to quick-acting valves, ends of long pipe runs, and near batteries of fixtures.

****

Provide commercial-type water hammer arresters on hot- and cold-water supplies. Arresters shall be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201 Sizing and Placement Data. Water hammer arresters, where concealed, shall be accessible by means of access doors or removable panels. Commercial-type water hammer arresters shall conform to ASSE 1010. Vertical capped pipe columns (air chambers) shall not be permitted.

3.3.8 Water Meter Remote Readout Register

a. Provide true absolute remote readout encoder register providing direct electronic transfer of meter reading information from water meter to automatic meter reading device. The remote register shall be mounted at the location indicated, or as directed by the Contracting Officer.

b. Provide permanently sealed register to exclude dirt and/or moisture infiltration. Provide with a straight reading odometer-type display, and 360 degree test circle with center sweep hand and low flow (leak) detector. Provide tamperproof locking feature to resist tampering with the register. Provide factory potted moisture resistant wire assembly for pit applications.

c. Provide registers with full 6-wheel encoding, and a 6-wheel odometer assembly for direct manual reading. The register shall transmit data using open architecture variable length protocol in ASCII format (American Standard Code for Information Interchange). Provide with capacity of remote installation up to 90 meters 300 feet to an outside wall mounted touch pad.

d. The register shall use an absolute encoder to directly read the actual position of the index odometer wheels, when interrogated by a reading device. The reading device shall provide all necessary power. Pulse outputs and/or memory shall not require programming. The register shall not require battery power to operate. When a reading device interrogates the register, the translator encoder shall communicate to the device in ASCII computer language the absolute meter reading, and an eight-digit identification number. Any error or nonread shall be immediately indicated by the meter reading equipment.

3.3.9 Backflow Prevention Devices

****

NOTE: The Air Force uses the Uniform Plumbing Code, for Air Force jobs backflow prevention installation

must meet the IAPMO UPC code.
****

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with [ICC IPC][ICC IPC][IAPMO UPC] at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit. Reduced pressure principle backflow prevention devices shall be installed horizontally and located in an accessible location not more than 1219 mm 4 feet above finished floor. Pipe drain from reduced pressure principle backflow prevention devices to the exterior, or a floor drain of adequate capacity, or a mop sink.

3.3.10 Copper-Silver Ionization Systems

a. System Bypass: Provide 3 valve bypass around system.

b. Testing: Provide one year of laboratory testing from [_____] distal sites for copper and silver ion levels to demonstrate appropriate levels for copper and silver. Copper level shall be 0.2 to 0.4 mg/L over baseline not to exceed Safe Drinking Water Act (40 CFR 143) level of 1.0 mg/L (1.3 mg/L is enforceable limit by EPA unless the applicable State has established a lower level). Silver level shall be 0.03 to 0.05 mg/L over baseline not to exceed Safe Drinking Water Act (40 CFR 143) of 0.1 mg/L (no maximum enforceable limit). Provide one test per quarter during the first year following Government acceptance of the facility. Provide factory test certifications attesting unit performance is meeting the requirements of this specification.

3.4 DRAINAGE AND VENT PIPING SYSTEMS

3.4.1 General

a. Provide wye fittings and eighth bends, or combination wye and eighth fittings at changes of direction and junctions. Sanitary tee fittings shall only be used in vertical pipe. Sanitary crosses are not permitted. Provide P-trap for each direct waste-pipe connection to equipment. Provide ice makers with an indirect drain consisting of either a floor sink or a dedicated, under-counter P-trap. Provide air gaps at indirect drains.

b. Install horizontal soil, waste, and storm piping with the following minimum slopes; 75 mm 3 inch and smaller pipes shall be 19 mm/m 1/4 inch per foot; 100 mm 4 inch to 150 mm 6 inch shall be 10 mm/m 1/8 inch per foot; 200 mm 8 inch and larger pipes: 5 mm/m 1/16 inch per foot. Slopes indicated on plans override those indicated here.

c. Provide vent stacks parallel to soil and waste stacks to receive branch

vents from fixtures. Each vent stack shall originate from a soil or waste stack at its base. To permit proper flashing, offset through-the-roof piping away from walls on roof before passing through roof. Carry vent stacks 100 mm 4 inch and larger full size through roof. Install vent lines so they will drain and not trap water. Where possible combine soil, waste or vent stacks before passing through roof to minimize roof openings. Where minimum vent-through-roof size is larger than vent size, provide increaser a minimum of 305 mm 12 inch below roof line.

d. Provide drip pans under drainage piping installed over critical areas to include but not limited to: operating rooms, recovery rooms, delivery rooms, nurseries, food preparation areas, food serving areas, food storage areas, central service areas, and electronic data processing areas. Provide drain piping from drip pans. Discharge drain piping to drain in exposed area.

e. Installed piping shall not be insulated, concealed, or furred around until it has been tested to satisfaction of the Contracting Officer. If inspection or test indicates defects, replace such defective work or material and repeat inspection and tests. Repairs shall be made with new materials. Peening and chiseling of holes or screwed joints is not allowed.

3.4.2 Pipe Cleanouts

****
NOTE: Specify cast-iron adjustable heads where heads are subject to loads, cleaning agents, and chemicals which will destroy heads made of plastic materials.
****

Pipe cleanouts shall be the same size as the pipe except that cleanout plugs larger than 100 mm 4 inches will not be required. A cleanout installed in connection with cast-iron soil pipe shall consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the location shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug shall be caulked into the hub of the fitting and shall be flush with the floor. Cleanouts in connection with other pipe shall be T-pattern, 90-degree branch drainage fittings with cast-brass screw plugs[, except plastic plugs shall be installed in plastic pipe]. Plugs shall be the same size as the pipe up to and including 100 mm 4 inches. Cleanout tee branches with screw plug shall be installed at the foot of soil and waste stacks, at the foot of interior downspouts, on each connection to building storm drain where interior downspouts are indicated, and on each building drain outside the building. Cleanout tee branches may be omitted on stacks in single story buildings with slab-on-grade construction or where less than 450 mm 18 inches of crawl space is provided under the floor. Cleanouts on pipe concealed in partitions shall be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers shall be provided and secured to plugs with securing screw. Square access covers may be provided with matching frames, anchoring lugs and cover screws. Cleanouts in finished walls shall have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic shall be provided with a chrome-plated cast brass, nickel brass, or nickel bronze cover secured to the plug or cover frame and set flush with the finished floor. Heads of fastening screws shall not

project above the cover surface. Where cleanouts are provided with adjustable heads, the heads shall be cast iron. Provide cleanout extensions through floor above where cleanouts are required in piping above critical areas, or to an accessible location outside of critical area.

3.4.3 Sight Drains

Sight drains shall be installed so that the indirect waste will terminate 50 mm 2 inches above the flood rim of the funnel to provide an acceptable air gap.

3.4.4 Traps

Each trap shall be placed as near the fixture as possible, and no fixture shall be double-trapped. Traps installed on cast-iron soil pipe shall be cast iron. Traps installed on steel pipe or copper tubing shall be recess-drainage pattern, or brass-tube type.[Traps installed on plastic pipe may be plastic conforming to ASTM D3311.] Traps for acid-resisting waste shall be of the same material as the pipe.

3.5 JOINTS

****
NOTE: Where environmental conditions do not warrant the use of dielectric unions or flanges the requirement for such unions and flanges will be deleted.
****

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

3.5.1 Threaded

Threaded joints shall have American Standard taper pipe threads conforming to ASME B1.20.2MASME B1.20.1. Only male pipe threads shall be coated with graphite or with an approved graphite compound, or with an inert filler and oil, or shall have a polytetrafluoroethylene tape applied.

3.5.2 Mechanical Couplings

Grooved mechanical joints shall be prepared according to the coupling manufacturer's instructions. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, or narrow-land micrometer. Groove width and dimension of groove from end of the pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations, such as behind solid walls or ceilings, unless an access panel is shown on the drawings for servicing or adjusting the joint.

3.5.3 Unions and Flanges

Unions, flanges and mechanical couplings shall not be concealed in walls, ceilings, or partitions. Unions shall be used on pipe sizes 65 mm 2-1/2

inches and smaller; flanges shall be used on pipe sizes 80 mm 3 inches and larger.

3.5.4 Grooved Mechanical Joints

****
NOTE: Do not use for Navy jobs.
****

Grooves shall be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools shall be products of the same manufacturer. Pipe and groove dimensions shall comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field shall be measured using a "go/no-go" gauge, vernier or dial caliper, narrow-land micrometer, or other method specifically approved by the coupling manufacturer for the intended application. Groove width and dimension of groove from end of pipe shall be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints shall not be used in concealed locations.

3.5.5 Cast Iron Soil Pipe

Bell and spigot compression and hubless gasketed clamp joints for soil, waste and vent piping shall be installed per the manufacturer's recommendations.

3.5.6 Copper Tube and Pipe

a. Brazed joints shall be made in conformance with AWS B2.2/B2.2M and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints shall include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) shall include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered joints shall be made with flux. Soldered joints shall conform to ASME B31.5 and CDA A4015.

c. Mechanically extracted joints shall be made in accordance with ICC IPC.

****
NOTE: Do NOT use the following paragraph for Navy projects.
****

d. Press connection. Copper press connections shall be made in strict accordance with the manufacturer's installation instructions for manufactured rated size. The joints shall be pressed using the tool(s) approved by the manufacturer of that joint. Minimum distance between fittings shall be in accordance with the manufacturer's requirements.

[3.5.7 Glass Pipe

Joints for corrosive waste glass pipe and fittings shall be made with corrosion-resisting steel compression-type couplings with acrylonitrile rubber gaskets lined with polytetrafluoroethylene.

][3.5.8 Corrosive Waste Plastic Pipe

Joints for polypropylene pipe and fittings shall be made by mechanical joint or electrical fusion coil method in accordance with ASTM D2657 and ASTM F 1290.

][3.5.9 Other Joint Methods

****
NOTE: Coordinate with paragraph MATERIALS.
****

Connections between ferrous and non-ferrous copper water pipe shall be made with dielectric unions or flange waterways. Dielectric waterways shall have temperature and pressure rating equal to or greater than that specified for the connecting piping. Waterways shall have metal connections on both ends suited to match connecting piping. Dielectric waterways shall be internally lined with an insulator specifically designed to prevent current flow between dissimilar metals. Dielectric flanges shall meet the performance requirements described herein for dielectric waterways. Connecting joints between plastic and metallic pipe shall be made with transition fitting for the specific purpose.

]3.6 CORROSION PROTECTION FOR BURIED PIPE AND FITTINGS

****
NOTE: Both cathodic protection and protective coatings, regardless of soil resistivity, are to be provided for steel, ductile iron, and cast iron pressurized piping under floor (slab on grade) in soil. The results of an economic analysis and recommendations by a "corrosion expert" will govern the application of cathodic protection and protective coatings on gravity sewer lines, regardless of soil resistivity, and for potable water lines in resistivities above 10000 ohm-centimeters. For a large majority of new facilities, a sacrificial type of cathodic protection system, as specified in Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE), would be the applicable section to reference; however, the plumbing designer must coordinate with the cathodic protection designer for selection of one or both of the CP specification options.
****

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be in accordance with [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [and] [Section 26 42 17.00 10 CATHODIC PROTECTION SYSTEM (IMPRESSED CURRENT)][Section 26 42 13.00 20 CATHODIC PROTECTION BY GALVANIC ANODES] [and] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT] [Section 26 42 14.00 10 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE)] [Section 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT]. Coatings shall be selected, applied, and inspected in accordance with

NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

3.7 PIPE SLEEVES AND FLASHING

Pipe sleeves shall be furnished and set in their proper and permanent location.

3.7.1 Sleeve Requirements

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NOTE: The designer will detail type of pipe sleeves on the drawings, illustrating method of sealing annular space between pipe and sleeve. The designer will coordinate requirements for clearances around sleeves with Section 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT for Army/Air Force projects and 22 05 48.00 20 MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL for Navy projects.
****

Pipes passing through concrete or masonry walls or concrete floors or roofs shall be provided with pipe sleeves fitted into place at the time of construction. Sleeves are not required for supply, drainage, waste and vent pipe passing through concrete slab on grade, except where penetrating a membrane waterproof floor. A modular mechanical type sealing assembly may be installed in lieu of a waterproofing clamping flange and caulking and sealing of annular space between pipe and sleeve. The seals shall consist of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and sleeve using galvanized steel bolts, nuts, and pressure plates. The links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Sleeves shall not be installed in structural members, except where indicated or approved. Rectangular and square openings shall be as detailed. Each sleeve shall extend through its respective floor, or roof, and shall be cut flush with each surface, except for special circumstances. Pipe sleeves passing through floors in wet areas such as mechanical equipment rooms, lavatories, kitchens, and other plumbing fixture areas shall extend a minimum of 100 mm 4 inches above the finished floor. Unless otherwise indicated, sleeves shall be of a size to provide a minimum of 6 mm 1/4 inch clearance between bare pipe or insulation and inside of sleeve or between insulation and inside of sleeve. Sleeves in bearing walls and concrete slab on grade floors shall be steel pipe or cast-iron pipe. Sleeves in nonbearing walls or ceilings may be steel pipe, cast-iron pipe, galvanized sheet metal with lock-type longitudinal seam, or plastic. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, shall be sealed with sealants conforming to ASTM C920 and with a primer, backstop material and surface preparation as specified in Section 07 92 00 JOINT SEALANTS. The annular space between pipe and

sleeve, between bare insulation and sleeve or between jacket over insulation and sleeve shall not be sealed for interior walls which are not designated as fire rated. Sleeves through below-grade walls in contact with earth shall be recessed 13 mm 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve shall be filled with backing material and sealants in the joint between the pipe and [concrete] [masonry] wall as specified above. Sealant selected for the earth side of the wall shall be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls shall conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.7.2 Flashing Requirements

****
NOTE: The applicable detail plates will be completed and included on the contract drawings. Sleeve thickness and square and rectangular opening details will be determined and indicated on the drawings. Indicate pipe chase areas on the drawings.
****

Pipes passing through roof shall be installed through a 4.9 kg per square meter 16 ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 200 mm 8 inches from the pipe and shall be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe a minimum of 250 mm 10 inches. For cleanouts, the flashing shall be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs shall be flashed, using lead or copper flashing, with an adjustable integral flange of adequate size to extend not less than 200 mm 8 inches from the pipe in all directions and lapped into the roofing to provide a watertight seal. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed as indicated. Flashing for dry vents shall be turned down into the pipe to form a waterproof joint. Pipes, up to and including 250 mm 10 inches in diameter, passing through roof or floor waterproofing membrane may be installed through a cast-iron sleeve with caulking recess, anchor lugs, flashing-clamp device, and pressure ring with brass bolts. Flashing shield shall be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane shall be sleeved as described above. A waterproofing clamping flange shall be installed.

3.7.3 Optional Counterflashing

Instead of turning the flashing down into a dry vent pipe, or caulking and sealing the annular space between the pipe and flashing or metal-jacket-covered insulation and flashing, counterflashing may be accomplished by utilizing the following:

a. A standard roof coupling for threaded pipe up to 150 mm 6 inches in diameter.

b. A tack-welded or banded-metal rain shield around the pipe.

3.7.4 Pipe Penetrations of Slab on Grade Floors

Where pipes, fixture drains, floor drains, cleanouts or similar items penetrate slab on grade floors, except at penetrations of floors with

waterproofing membrane as specified in paragraphs Flashing Requirements and Waterproofing, a groove 6 to 13 mm 1/4 to 1/2 inch wide by 6 to 10 mm 1/4 to 3/8 inch deep shall be formed around the pipe, fitting or drain. The groove shall be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

3.7.5 Pipe Penetrations

Provide sealants for all pipe penetrations. All pipe penetrations shall be sealed to prevent infiltration of air, insects, and vermin.

3.7.6 Fire Seal

****
NOTE: Normally, fire walls and fire partitions will be designated on the architectural drawings.
****

Where pipes pass through fire walls, fire-partitions, fire-rated pipe chase walls or floors above grade, a fire seal shall be provided as specified in Section 07 84 00 FIRESTOPPING.

3.8 PIPE HANGERS, INSERTS, AND SUPPORTS

****
NOTE: Mechanical and electrical layout drawings and specifications for ceiling suspensions should contain notes indicating that hanger loads between panel points in excess of 22.7 kg (50 pounds) shall have the excess hanger loads suspended from panel points.
****

Installation of pipe hangers, inserts and supports shall conform to MSS SP-58 and MSS SP-69, except as modified herein.

a. Type 1, provide with adjustable type steel support rods.

b. Types 5, 12, and 26 shall not be used.

c. Type 3 shall not be used on insulated pipe.

d. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

e. Type 19 and 23 C-clamps shall be used for attachment to steel joists and shall be torqued per MSS SP-69. Provide both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

f. Type 20 attachments shall be used on steel angles and vertical web steel channels and shall be furnished with an added malleable-iron heel plate or adapter. Attach to horizontal web steel channel with drilled hole on centerline and double nut and washer.

g. Type 21, 28, 29, and 30 clamps shall be used for attachment to steel W or S beams.

h. Type 24 may be used only on trapeze hanger systems or on fabricated frames.

i. Type 39 saddles shall be used on insulated pipe 100 mm 4 inches and larger when the temperature of the medium is 15 degrees C 60 degrees F or higher. Type 39 saddles shall be welded to the pipe.

j. Type 40 shields shall:

(1) Be used on insulated pipe less than 100 mm 4 inches.

(2) Be used on insulated pipe 100 mm 4 inches and larger when the temperature of the medium is 15 degrees C 60 degrees F or less.

(3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter 8 pcf or greater.

k. Horizontal pipe supports shall be spaced as specified in MSS SP-69 and a support shall be installed not over 300 mm 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C 120 degrees F for PVC and 82 degrees C 180 degrees F for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.

l. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m 15 feet nor more than 2 m 8 feet from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.

m. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:

(10 On pipe 100 mm 4 inches and larger when the temperature of the medium is 15 degrees C 60 degrees F or higher, a Type 39 saddle, welded to the pipe, may freely rest on a steel plate.

(2) On pipe less than 100 mm 4 inches a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

(3) On pipe 100 mm 4 inches and larger carrying medium less than 15 degrees C 60 degrees F a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

n. Pipe hangers on horizontal insulated pipe shall be the size of the outside diameter of the insulation. The insulation shall be continuous through the hanger on all pipe sizes and applications.

o. Where there are high system temperatures and welding to piping is not desirable, the type 35 guide shall include a pipe cradle, welded to the guide structure and strapped securely to the pipe. The pipe shall be separated from the slide material by at least 100 mm 4 inches or by an amount adequate for the insulation, whichever is greater.

p. Hangers and supports for plastic pipe shall not compress, distort, cut or abrade the piping, and shall allow free movement of pipe except where otherwise required in the control of expansion/contraction.

q. Hangers used to support piping 50 mm 2 inches and larger shall be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors shall be installed to keep pipes in accurate alignment, to direct the expansion movement, and to prevent buckling, swaying, and undue strain. Piping subjected to vertical movement when operating temperatures exceed ambient temperatures shall be supported by variable spring hangers and supports or by constant support hangers. In the support of multiple pipe runs on a common base member, a clip or clamp shall be used where each pipe crosses the base support member. Spacing of the base support members shall not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods shall not be formed or bent.

3.8.1 Seismic Requirements

****
NOTE: Provide seismic requirements or piping and related equipment supports and show on the drawings.
****

Piping and attached valves shall be supported and braced to resist seismic loads as specified in Section 13 48 00 SEISMIC PROTECTION FOR MISCELLANEOUS EQUIPMENT and [Section 13 48 00.00 10 SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT][Section 22 05 48.00 20 MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL] [as shown]. Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided. Material used for supports shall be as specified in[Section 05 12 00 STRUCTURAL STEEL] [Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS].

3.8.2 Structural Attachments

Attachment to building structure concrete and masonry shall be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors shall be applied with a safety factor not less than 5. Supports shall not be attached to metal decking. Supports shall not be attached to the underside of concrete filled floor or concrete roof decks unless approved by the Contracting Officer. Masonry anchors for overhead applications shall be constructed of ferrous materials only.

3.9 FIXTURES AND FIXTURE TRIMMINGS

Polished chromium-plated pipe, valves, and fittings shall be provided where exposed to view. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield, and loose-key pattern stops for supplies with threaded, sweat or solvent weld inlets shall be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool shall be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Drain lines and hot water lines of fixtures for handicapped/accessible fixtures shall be insulated and do not require

polished chrome finish. Plumbing fixtures and accessories shall be installed within the space shown.

3.9.1 Fixture Connections

Connections between earthenware fixtures and flanges on soil pipe shall be made gastight and watertight with a closet-setting compound or neoprene gasket and seal. Use of natural rubber gaskets or putty will not be permitted. Fixtures with outlet flanges shall be set the proper distance from floor or wall to make a first-class joint with the closet-setting compound or gasket and fixture used.

3.9.2 Flushometer Valves

****
NOTE: Delete sentence describing location of flush valve handle when an automatic flushing system is provided.
****

Flushometer valves shall be secured to prevent movement by anchoring the long finished top spud connecting tube to wall adjacent to valve with approved metal bracket. Flushometer valves for water closets shall be arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle shall be installed on the wide side of the enclosure. Bumpers for water closet seats shall be installed on the wall.

3.9.3 Height of Fixture Rims Above Floor

Unless otherwise noted, mounting heights shall be as indicated. Installation of fixtures for use by the physically handicapped shall be in accordance with ICC/ANSI A117.1.

3.9.4 Shower Bath Outfits

The area around the water supply piping to the mixing valves and behind the escutcheon plate shall be made watertight by caulking or gasketing.

3.9.5 Fixture Supports

****
NOTE: Project drawings will detail methods of hanging lavatories and wall-hung urinals. Normally, these fixtures will be supported by one of the methods described.
****

Fixture supports for off-the-floor lavatories, urinals, water closets, and other fixtures of similar size, design, and use, shall be of the chair-carrier type. The carrier shall provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability shall be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, shall be fastened to the wall structure only where it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.9.5.1 Support for Solid Masonry Construction

Chair carrier shall be anchored to the floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be imbedded in the masonry wall.

3.9.5.2 Support for Concrete-Masonry Wall Construction

Chair carrier shall be anchored to floor slab. Where a floor-anchored chair carrier cannot be used, a suitable wall plate shall be fastened to the concrete wall using through bolts and a back-up plate.

3.9.5.3 Support for Steel Stud Frame Partitions

Chair carrier shall be used. The anchor feet and tubular uprights shall be of the heavy duty design; and feet (bases) shall be steel and welded to a square or rectangular steel tube upright. Wall plates, in lieu of floor-anchored chair carriers, shall be used only if adjoining steel partition studs are suitably reinforced to support a wall plate bolted to these studs.

3.9.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier shall be used. Where entire construction is wood, wood crosspieces shall be installed. Fixture hanger plates, supports, brackets, or mounting lugs shall be fastened with not less than No. 10 wood screws, 6 mm 1/4 inch thick minimum steel hanger, or toggle bolts with nut. The wood crosspieces shall extend the full width of the fixture and shall be securely supported.

3.9.5.5 Wall-Mounted Water Closet Gaskets

Where wall-mounted water closets are provided, reinforced wax, treated felt, or neoprene gaskets shall be provided. The type of gasket furnished shall be as recommended by the chair-carrier manufacturer.

3.9.6 Access Panels

Access panels shall be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels shall be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels shall be as specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS.

3.9.7 Shower Pans

Before installing shower pan, subfloor shall be free of projections such as nail heads or rough edges of aggregate. Drain shall be a bolt-down, clamping-ring type with weepholes, installed so the lip of the subdrain is flush with subfloor.

3.9.7.1 General

The floor of each individual shower, the shower-area portion of combination shower and drying room, and the entire shower and drying room where the two are not separated by curb or partition, shall be made watertight with a shower pan fabricated in place. The shower pan material shall be cut to size and shape of the area indicated, in one piece to the maximum extent practicable, allowing a minimum of 150 mm 6 inches for turnup on walls or

partitions, and shall be folded over the curb with an approximate return of 1/4 of curb height. The upstands shall be placed behind any wall or partition finish. Subflooring shall be smooth and clean, with nailheads driven flush with surface, and shall be sloped to drain. Shower pans shall be clamped to drains with the drain clamping ring.

3.9.7.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces shall be joined with a flatlock seam and soldered or burned. The corners shall be folded, not cut, and the corner seam shall be soldered or burned. Pans, including upstands, shall be coated on all surfaces with one brush coat of asphalt. Asphalt shall be applied evenly at not less than 1 liter per square meter 1 gallon per 50 square feet. A layer of felt covered with building paper shall be placed between shower pans and wood floors. The joining surfaces of metal pan and drain shall be given a brush coat of asphalt after the pan is connected to the drain.

3.9.8 Escutcheons

Escutcheons shall be provided at finished surfaces where bare or insulated piping, exposed to view, passes through floors, walls, or ceilings, except in boiler, utility, or equipment rooms. Escutcheons shall be fastened securely to pipe or pipe covering and shall be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons shall be one-piece held in place by setscrew.

3.10 WATER HEATERS AND HOT WATER STORAGE TANKS

3.10.1 Relief Valves

****

NOTE: A discharge pipe the full size of the relief valve outlet will be shown connected to the outlet and shown on the drawings terminated at a safe location. The discharge pipe shall not be directly connected to the drainage system and will conform to the requirements of the International Plumbing Code (for commercial and industrial hot water heaters ASME BPVC SEC IV also applies).

****

No valves shall be installed between a relief valve and its water heater or storage tank. The pressure and temperature relief valve shall be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve shall be installed directly in a tapping in the tank or heater; otherwise, the pressure and temperature valve shall be installed in the hot-water outlet piping. A vacuum relief valve shall be provided on the cold water supply line to the hot-water storage tank or water heater and mounted above and within 150 mm 6 inches above the top of the tank or water heater.

3.10.2 Connections to Water Heaters

Connections of metallic pipe to water heaters shall be made with dielectric unions or flanges.

3.10.3 Expansion Tank

A pre-charged expansion tank shall be installed on the cold water supply between the water heater inlet and the cold water supply shut-off valve. Adjust the expansion tank air pressure, as recommended by the tank manufacturer, to match incoming water pressure.

3.10.4 Gas- and Oil-Fired Water Heaters

Installation shall conform to NFPA 54 for gas fired and NFPA 31 for oil fired.

[3.10.5 Direct Fired Domestic Water Heaters

****
NOTE: For Navy projects, any boilers or direct fired domestic water heaters over 117,124.2 Watts (400,000 BTU/hour) are required to be inspected and certified in accordance with Unified Facilities Criteria UFC 3-430-7, "Operations and Maintenance: Inspection and Certification of Boilers and Unfired Pressure Vessels" . If the inspection is performed by contract, the inspector must be certified by one of the NAVFAC Senior Boiler Inspectors. If this project has a water heater meeting these requirements, add the following paragraph.
****

Notify the Contracting Officer when any direct fired domestic water heater over 117,124.2 Watts (400,000 BTU/hour) is operational and ready to be inspected and certified.

]3.11 IDENTIFICATION SYSTEMS

3.11.1 Identification Tags

****
NOTE: Delete when identification tags are not considered necessary on small projects.
****

Identification tags made of brass, engraved laminated plastic, or engraved anodized aluminum, indicating service and valve number shall be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags shall be 35 mm 1-3/8 inch minimum diameter, and marking shall be stamped or engraved. Indentations shall be black, for reading clarity. Tags shall be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.11.2 Nameplates

Provide 3.2 mm 1/8 inch thick melamine laminated plastic nameplates, black matte finish with white center core, for equipment, gages, thermometers, and valves; valves in supplies to faucets will not require nameplates. Accurately align lettering and engrave minimum of 6.4 mm 1/4 inch high normal block lettering into the white core. Minimum size of nameplates shall be 25 by 63 mm 1 by 2-1/2 inches. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and

schedule.

3.11.3 Labels

****
NOTE: Labeling of components is an inexpensive and effective method for helping building occupants properly operate the systems and for helping facilities personnel properly maintain the systems. The labels should be easy to read when standing next to the equipment, and durable to match the life of the equipment to which they are attached. Delete item c for non-battery operated units.

This is optional for Army projects.
****

Provide labels for sensor operators at flush valves and faucets. Include the following information on each label:

a. Identification of the sensor and its operation with [graphic] [written] [Braille] description.

b. Range of the sensor.

c. Battery replacement schedule.

3.11.4 Pipe Color Code Marking

****
NOTE: Designer will coordinate color code marking with Section 09 90 00. Color code marking for piping not listed in Table I of Section 09 90 00, will be added to the table.
****

Color code marking of piping shall be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.11.5 Color Coding Scheme for Locating Hidden Utility Components

****
NOTE: The Color Code Table will be developed to suit the installation. The colors of metal disks used in Army projects will be as directed by the Facilities Engineer. Identification plate specified in Section 09 90 00 PAINTS AND COATINGS will be deleted if color coding scheme is specified.
****

Scheme shall be provided in buildings having suspended grid ceilings. The color coding scheme shall identify points of access for maintenance and operation of operable components which are not visible from the finished space and installed in the space directly above the suspended grid ceiling. The operable components shall include valves. The color coding scheme shall consist of a color code board and colored metal disks. Each colored metal disk shall be approximately 10 mm 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners shall be inserted into the ceiling panels so that the fasteners will be concealed

from view. The fasteners shall be manually removable without tools and shall not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks shall follow completion of the finished surface on which the disks are to be fastened. The color code board shall have the approximate dimensions of 1 m 3 foot width, 750 mm 30 inches height, and 13 mm 1/2 inch thickness. The board shall be made of wood fiberboard and framed under glass or 1.6 mm 1/16 inch transparent plastic cover. Unless otherwise directed, the color code symbols shall be approximately 19 mm 3/4 inch in diameter and the related lettering in 13 mm 1/2 inch high capital letters. The color code board shall be mounted and located in the mechanical or equipment room. The color code system shall be as indicated below:

Color	System	Item	Location
[_____]	[_____]	[_____]	[_____]

3.12 PAINTING

3.12.1 General

Painting of pipes, hangers, supports, and other iron work, either in concealed spaces or exposed spaces, is specified in Section 09 90 00 PAINTS AND COATINGS. New equipment painting shall be factory applied or shop applied, and shall be as specified herein or in PART 2 paragraph FACTORY PAINTING, and provided under each individual section.

3.12.2 Shop Painting Systems for Metal Surfaces

a. Clean, pretreat, prime and paint metal surfaces; except aluminum surfaces need not be painted. Apply coatings to clean dry surfaces. Clean the surfaces to remove dust, dirt, rust, oil and grease by wire brushing and solvent degreasing prior to application of paint, except metal surfaces subject to temperatures in excess of 50 degrees C 120 degrees F shall be cleaned to bare metal.

b. Where more than one coat of paint is specified, apply the second coat after the preceding coat is thoroughly dry. Lightly sand damaged painting and retouch before applying the succeeding coat. Color of finish coat shall be aluminum or light gray.

(1) Temperatures Less Than 50 Degrees C 120 Degrees F: Immediately after cleaning, the metal surfaces shall receive one coat of pretreatment primer applied to a minimum dry film thickness of 0.0076 mm 0.3 mil, one coat of primer applied to a minimum dry film thickness of 0.0255 mm one mil; and two coats of enamel applied to a minimum dry film thickness of 0.0255 mm one mil per coat.

(2) Temperatures Between 50 and 205 Degrees C 120 and 400 Degrees F: Metal surfaces shall receive two coats of 205 degrees C 400 degrees F heat-resisting enamel applied to a total minimum thickness of 0.05 mm 2 mils.

(3) Temperatures Greater Than 205 Degrees C 400 Degrees F: Metal surfaces shall receive two coats of 315 degrees C 600 degrees F heat-resisting paint applied to a total minimum dry film thickness of 0.05 mm 2 mils.

[3.13 VIBRATION-ABSORBING FEATURES

****

NOTE: Indicate on the drawings where equipment should be mounted resiliently. Details for proper mounting of equipment will be indicated on the drawings. Insert required isolation efficiency in the blank space for installations where specific values for reduction of noise and vibration transmission are necessary; otherwise the sentence will be deleted. For areas where the maximum tolerable transmissibility in percent is considered necessary, the isolation efficiency will be given. Recommended transmissibility in percentages is as follows: 10 percent for equipment mounted in very critical areas, 10 to 20 percent for critical areas, and 20 to 40 percent for noncritical areas. The drawings should be checked to ensure that all structural and equipment connection factors or conditions surrounding the equipment, which is to be provided with vibration isolation units, favorably influence the effectiveness of the isolators. Where many items of equipment require different transmission values, because of different equipment locations, the paragraph may be revised to indicate the appropriate values on the drawings.

Delete submittal of Vibration-Absorption Features when not required.

****

Mechanical equipment, including pumps, shall be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Each foundation shall include an adequate number of standard isolation units. Each unit shall consist of machine and floor or foundation fastening, together with intermediate isolation material, and shall be a standard product with printed load rating. Piping connected to mechanical equipment shall be provided with flexible connectors. Isolation unit installation shall limit vibration to [_____] percent of the lowest equipment rpm. Submit details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications.

]3.14 TRAINING

a. Provide the services of competent instructors to give full instruction to the designated Government personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the specified equipment or system. Instructors shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

b. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Government for regular operation. The number of man-days (8 hours per day) of instruction furnished shall be as specified in the individual section. When more than 4 man-days of instruction are specified, use approximately half of the time for classroom instruction. Use other time for instruction with the equipment or system.

c. When significant changes or modifications in the equipment or system are made under the terms of the contract, provide additional instruction to acquaint the operating personnel with the changes or modifications.

3.15 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, shall be posted where directed. Condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system shall be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions shall be posted before acceptance testing of the systems.

3.16 TESTS, FLUSHING AND DISINFECTION

****

NOTE: Some facilities may require a conditioning/flushing of water fountains and faucets that are listed as end point devices by NSF/ANSI 61, Section 9. This is to meet possible customer expectations that these devices produce drinking water that meets the lead leaching requirements of NSF/ANSI 61 immediately upon beneficial occupancy. If the customer is not willing to allow the end point devices to "self-condition" after project turn-over, then the designer should edit the paragraph titled System Flushing, requiring the Contractor to flush the drinking water fountains and faucets.

****

Submit test reports in booklet form showing all field tests performed to adjust each component and all field tests performed to prove compliance with the specified performance criteria, completion and testing of the installed system. Each test report shall indicate the final position of controls.

3.16.1 Plumbing System

****

NOTE: For Air Force projects backflow prevention equipment and installation must meet the IAPMO UPC code.

****

The following tests shall be performed on the plumbing system in accordance with [ICC IPC][ICC IPC][IAPMO UPC], except that the drainage and vent system final test shall include the smoke test. The Contractor has the option to perform a peppermint test in lieu of the smoke test. If a peppermint test is chosen, submit a testing procedure to the Contracting Officer for approval.

a. Drainage and Vent Systems Test. The final test shall include a smoke test.

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.16.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies. Certification of proper operation shall be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, have the manufacturer's representative test the device, to ensure the unit is properly installed and performing as intended. Submit written documentation of the tests performed and signed by the individual performing the tests. Gauges shall be tested annually for accuracy in accordance with the University of Southern California's Foundation of Cross Connection Control and Hydraulic Research or the American Water Works Association Manual of Cross Connection (Manual M-14). Report form for each assembly shall include, as a minimum, the following:

Data on Device	Data on Testing Firm
Type of Assembly	Name
Manufacturer	Address
Model Number	Certified Tester
Serial Number	Certified Tester No.
Size	Date of Test
Location	
Test Pressure Readings	Serial Number and Test Data of Gauges

If the unit fails to meet specified requirements, the unit shall be repaired and retested.

3.16.1.2 Shower Pans

After installation of the pan and finished floor, the drain shall be temporarily plugged below the weep holes. The floor area shall be flooded with water to a minimum depth of 25 mm 1 inch for a period of 24 hours. Any drop in the water level during test, except for evaporation, will be reason for rejection, repair, and retest.

3.16.1.3 Submittal Requirements

Submit the following:

Detail drawings for the complete plumbing system including piping layouts and locations of connections; dimensions for roughing-in, foundation, and support points; schematic diagrams and wiring diagrams or connection and interconnection diagrams. Detail drawings shall indicate clearances required for maintenance and operation. Where piping and equipment are to be supported

other than as indicated, details shall include loadings and proposed support methods. Plan, elevation, view, and detail drawings, shall be drawn to scale.

Diagrams, instructions, and other sheets proposed for posting. Manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe.

Manuals in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

3.16.2 Defective Work

If inspection or test shows defects, such defective work or material shall be replaced or repaired as necessary and inspection and tests shall be repeated. Repairs to piping shall be made with new materials. Caulking of screwed joints or holes will not be acceptable.

3.16.3 System Flushing

3.16.3.1 During Flushing

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NOTE: Hot water flushing dissolves most excess petrolatum-based flux inside piping, helping to avoid future corrosion problems.
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Before operational tests or disinfection, potable water piping system shall be flushed with [hot] potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second 4 fps through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall specify the number of fixtures to be operated during flushing. Provide adequate personnel to monitor the flushing operation and to ensure that drain lines are unobstructed in order to prevent flooding of the facility. Contractor is responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. [All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 1 L 0.25 gallons per 24 hour period, ten times over a 14 day period.]

3.16.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - SI ASHRAE 90.1 - IP for minimum efficiency

requirements.[Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 50.12 Part 141.80(c)(1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.]

3.16.4 Operational Test

Upon completion of flushing and prior to disinfection procedures, subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:

a. Time, date, and duration of test.

b. Water pressures at the most remote and the highest fixtures.

c. Operation of each fixture and fixture trim.

d. Operation of each valve, hydrant, and faucet.

e. Pump suction and discharge pressures.

f. Temperature of each domestic hot-water supply.

g. Operation of each floor and roof drain by flooding with water.

h. Operation of each vacuum breaker and backflow preventer.

i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.

3.16.5 Disinfection

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NOTE: If government laboratory facilities are available to conduct the bacterial examination of the test samples, revise this paragraph accordingly. The option of having the Contracting Officer perform the sampling and testing will be selected only if Government laboratory facilities are available and with concurrence from appropriate laboratory personnel. At some locations, either county or installation health officers inspect the disinfection process. If this is required, add a notification requirement and give the office to be notified, including phone number. For modification of existing systems, provide special procedures for disinfection of new equipment.
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After operational tests are complete, disinfect the entire domestic hot- and cold-water distribution system. Flush the system as specified, before introducing chlorinating material. The chlorinating material shall be hypochlorites or liquid chlorine. Except as herein specified, water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652. The chlorinating material shall be fed into the water piping system at a

constant rate at a concentration of at least 50 parts per million (ppm). Use a properly adjusted hypochlorite solution injected into the main with a hypochlorinator, or liquid chlorine injected into the main through a solution-feed chlorinator and booster pump. If after the 24 hour and 6 hour holding periods, the residual solution contains less than 25 ppm and 50 ppm chlorine respectively, flush the piping and tank with potable water, and repeat the above procedures until the required residual chlorine levels are satisfied. The system, including the tanks, shall then be flushed with clean water until the residual chlorine level is reduced to less than one part per million. During the flushing period each valve and faucet shall be opened and closed several times. Samples of water in disinfected containers shall be obtained from several locations selected by the Contracting Officer. The samples of water shall be tested for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with AWWA 10084. The testing method used shall be either the multiple-tube fermentation technique or the membrane-filter technique. Disinfection shall be repeated until tests indicate the absence of coliform organisms (zero mean coliform density per 100 milliliters) in the samples for at least 2 full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

[3.16.6 Optional Disinfection Method

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NOTE: For Iceland projects only, include the following option.
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Disinfect new potable water piping and affected portions of existing potable water piping with geothermal water. Geothermal water shall be not less than 90 degrees C 194 degrees F and contact time shall be not less than 30 minutes. After disinfection, thoroughly flush new portable water piping and affected portions of existing potable water piping with the chlorinated base water supply for a minimum of two hours.

]3.17 WASTE MANAGEMENT

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NOTE: Coordinate with Section 02 41 00 [DEMOLITION] [AND] [DECONSTRUCTION]
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Place materials defined as hazardous or toxic waste in designated containers. Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal. Close and seal tightly partly used sealant and adhesive containers and store in protected, well-ventilated, fire-safe area at moderate temperature. Place used sealant and adhesive tubes and containers in areas designated for hazardous waste. Separate copper and ferrous pipe waste in accordance with the Waste Management Plan and place in designated areas for reuse.

-- End of Section --