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USACE / NAVFAC / AFCEC | **UFGS-22 00 00 (May 2024)**
Change 1 - 11/24
Preparing Activity: NAVFAC | **Superseding**
UFGS-22 00 00 (November 2015)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2024

****

SECTION TABLE OF CONTENTS

DIVISION 22 - PLUMBING

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE

05/24, CHG 1: 11/24

2.3.6 Outlet Boxes
2.3.6.1 Washer Box
2.3.6.2 Ice Maker Box
2.3.7 Relief Valves
2.3.8 Thermostatic Mixing Valves
2.3.9 Temperature Controlled Mixing Valve
2.3.10 Point-of-Use Mixing Valve
2.3.11 Automatic Temperature [and][or] Pressure Compensating Valve
2.3.12 Temperature Actuated Mixing Valve
2.3.13 Single Supply Line Automatic Temperature Control
2.4 FIXTURES
2.4.1 Lavatories
2.4.2 Automatic Controls
2.4.3 Flush Valve Water Closets
2.4.3.1 Flush Valve Water Closet Type and Mount
2.4.3.2 Flush Valve Water Closet Flush and Flow
2.4.3.3 Flush Valve Water Closet Control Valve
2.4.4 Flush Valve Urinals
2.4.5 Wheelchair Flush Valve Type Urinals
2.4.6 No-Water Urinals
2.4.7 Non-Water Use Urinals
2.4.8 Flush Tank Water Closets
2.4.9 Non-Flushing Toilets
2.4.10 Wall Hung Lavatories
2.4.11 Countertop Lavatories
2.4.12 Washfountains
2.4.13 Lavatory Systems, Single or Multiple Stations
2.4.14 Kitchen Sinks
2.4.15 Service Sinks
2.4.16 Drinking-Water Coolers for Standing Person
2.4.17 Wheelchair Drinking Water Cooler
2.4.18 Energy Star Label for Freestanding Bottled Water Coolers/Dispensers
2.4.18.1 Bottled Water Dispenser
2.4.18.2 Bottleless Water Dispenser
2.4.19 Shower Faucets
2.4.20 Plastic Bathtub/Shower Units
2.4.21 Plastic Bathtubs
2.4.22 Plastic Shower Stalls
2.4.22.1 Standard Shower Stall
2.4.22.2 Transfer Type Shower Stall (ADA)
2.4.22.3 Standard Roll-in Type Shower Stall (ADA)
2.4.23 Plastic Bathtub Liners
2.4.24 Plastic Bathtub Wall Surrounds
2.4.25 Precast Terrazzo Shower Floors
2.4.26 Precast Terrazzo Mop Sinks
2.4.27 Bathtubs, Cast Iron
2.4.28 Bathtubs, Porcelain
2.4.29 Emergency Eyewash and Shower
2.4.30 Emergency Eye and Face Wash
2.4.31 Emergency Eyewash
2.4.32 Portable, Self-Contained Eyewash Unit
2.5 BACKFLOW PREVENTERS
2.6 DRAINS
2.6.1 Floor and Shower Drains
2.6.1.1 Metallic Shower Pan Drains
2.6.1.2 Drains and Backwater Valves
2.6.2 Bathtub and Shower Faucets and Drain Fittings
2.6.3 Area Drains

2.6.4 Floor Sinks
2.6.5 Boiler Room Drains
2.6.6 Pit Drains
2.6.7 Sight Drains
2.6.8 Roof Drains and Expansion Joints
2.6.9 Swimming Pool [and Spa]Suction Fittings
2.6.10 Trap Seal Protection
2.6.10.1 Potable Water-Supplied Trap Seal Valve
2.6.10.2 Reclaimed Or Gray Water-Supplied Trap Seal Valve
2.6.10.3 Waste Water-Supplied Trap Seal Device
2.6.10.4 Barrier-Type Trap Seal Protection Device
2.6.10.5 Electronic Trap Seal Primer
2.7 SHOWER PAN
2.7.1 Sheet Copper
2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material
2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material
2.8 TRAPS
2.9 INTERCEPTORS
2.9.1 Grease Interceptor
2.9.1.1 Gravity Grease Interceptor
2.9.1.2 Hydromechanical Grease Interceptor
2.9.2 Oil Interceptor
2.9.3 Sand Interceptors
2.9.4 Lint Interceptors
2.10 WATER HEATERS
2.10.1 Automatic Storage Type
2.10.1.1 Oil-Fired Type
2.10.1.2 Gas-Fired Type
2.10.1.3 Electric Type
2.10.1.4 Indirect Heater Type
2.10.2 Instantaneous Water Heater
2.10.3 Electric Instantaneous Water Heaters (Tankless)
2.10.4 Phenolic Resin Coatings for Heater Tubes
2.10.4.1 Standard Product
2.10.4.2 Expansion Tank
2.11 HOT-WATER STORAGE TANKS
2.12 PUMPS
2.12.1 Sump Pumps
2.12.2 Circulating Pumps
2.12.2.1 Circulating Pump Enclosure
2.12.2.2 Circulating Pump Size and Efficiency
2.12.3 Booster Pumps
2.12.3.1 Centrifugal Pumps
2.12.3.2 Controls
2.12.4 Flexible Connectors
2.12.5 Sewage Pumps
2.13 WATER PRESSURE BOOSTER SYSTEM
2.13.1 Constant Speed Pumping System
2.13.2 Hydro-Pneumatic Water Pressure System
2.13.3 Variable Speed Pumping System
2.14 COMPRESSED AIR SYSTEM
2.14.1 Air Compressors
2.14.2 Lubricated Compressors
2.14.3 Air Receivers
2.14.4 Intake Air Supply Filter
2.14.5 Pressure Regulators
2.15 DOMESTIC WATER SERVICE METER
2.16 POOL WATER PUMP SAFETY VACUUM RELEASE SYSTEM (SVRS)
2.17 ELECTRICAL WORK

-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC	**UFGS-22 00 00 (May 2024)** **Change 1 - 11/24**
Preparing Activity: NAVFAC	**Superseding** **UFGS-22 00 00 (November 2015)**

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****

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE
05/24, CHG 1: 11/24

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NOTE: This guide specification covers the requirements for general purpose plumbing systems including 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 Plumbing Code (ICC IPC) which is required by UFC 1-200-01.

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 item(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).

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PART 1 GENERAL

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NOTE: This guide specification covers general purpose type plumbing systems. This specification essentially implements the requirements of the International Plumbing Code (IPC). Equipment supports and connections, for either equipment on the ground or in the building, will conform to these

requirements.

This section contains tailoring options for PIPING, FIXTURES, WATER HEATERS, PUMPS, PRESSURE PIPING, COMPRESSED AIR SYSTEM, ARMY, AIR FORCE,and NAVY.

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NOTE: The following information must be shown on project drawings (Item 6 is tailored for ARMY):

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

2. Show 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. Note: This will clean the strainer each time the wall hydrant is used.

3. Show 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. Show location of each sectionalizing valve in each water system. Sectionalizing valves should be ball valves.

5. Show location of each solenoid-operated flush valve and solenoid-operated lavatory faucet on project drawings.

6. Minimize the risk of Legionellosis in building water systems by following guidance in the U.S. Army Corps of Engineers Engineering Manual (EM) 200-1-13 (2016), Minimizing The Risk of Legionellosis Associated with Building Water Systems on Army Installations.

7. For Tri-Service projects, minimize the risk of legionellosis in building water systems by utilizing the guidance in the Association of Water Technologies, (2019) Legionella: A Position Statement and Guidance Document, ASHRAE Guideline 12, ASHRAE Standard 188 and the Cooling Technology Institute GDL 159 and (2008) Legionellosis Guideline: Best Practices for Control of Legionella.

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1.1 REFERENCES

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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 Identifier (RID) 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.

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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.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE (AHRI)

ANSI/AHRI 1160 I-P	(2022) Performance Rating of Heat Pump Pool Heaters
ANSI/AHRI 1161 SI	(2014) Performance Rating of Heat Pump Pool Heaters

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z21.10.1/CSA 4.1	(2019) 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	(2019) Gas-Fired 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	(2015; R 2020) Relief Valves for Hot Water Supply Systems

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

ANSI/ASHRAE 18	(2008; R 2013) Methods Of Testing For Rating Drinking Water Coolers With Self-Contained Mechanical Refrigeration
ASHRAE 90.1 - IP	(2019) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 90.1 - SI	(2019) Energy Standard for Buildings Except Low-Rise Residential Buildings
ASHRAE 146	(2020) Method of Testing and Rating Pool Heaters (ANSI Approved)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.1.2	(2012; R 2017; R 2022) Air Gaps in Plumbing Systems (For Plumbing Fixtures and Water-Connected Receptors)
ASME A112.6.1M	(1997; R 2017) Floor Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.6.3	(2022) Floor Drains
ASME A112.6.4	(2022) Roof, Deck and Balcony Drains
ASME A112.14.1	(2003; R 2017; R 2022) Backwater Valves
ASME A112.18.1/CSA B125.1	(2018) Plumbing Supply Fittings
ASME A112.19.1/CSA B45.2	(2024) Enameled Cast Iron and Enameled Steel Plumbing Fixtures
ASME A112.19.2/CSA B45.1	(2018; ERTA 2018) Standard for Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals
ASME A112.19.3/CSA B45.4	(2022) Stainless Steel Plumbing Fixtures
ASME A112.19.5	(2022) Flush Valves and Spuds for Water Closets, Urinals, and Tanks
ASME A112.19.17	(2010; R 2018; R 2023) Manufactured Safety Vacuum Release Systems (SVRS) for Residential and Commercial Swimming Pool, Spa, Hot Tub, and Wading Pool Suction Systems
ASME A112.36.2M	(2022) Cleanouts
ASME B1.20.1	(2013; R 2018) Pipe Threads, General Purpose (Inch)
ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.4	(2021) Gray Iron Threaded Fittings; Classes 125 and 250
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.12	(2019) Cast Iron Threaded Drainage Fittings
ASME B16.15	(2024) Cast Copper Alloy Threaded Fittings Classes 125 and 250
ASME B16.18	(2021) Cast Copper Alloy Solder Joint Pressure Fittings
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe

	Flanges
ASME B16.22	(2021) Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME B16.23	(2021) Cast Copper Alloy Solder Joint Drainage Fittings - DWV
ASME B16.24	(2022) Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves Classes 150, 300, 600, 900, 1500, and 2500
ASME B16.29	(2022) Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings - DWV
ASME B16.34	(2021) Valves - Flanged, Threaded and Welding End
ASME B16.39	(2020) Standard for Malleable Iron Threaded Pipe Unions; Classes 150, 250, and 300
ASME B16.50	(2021) Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings
ASME B16.51	(2013) Copper and Copper Alloy Press-Connect Pressure Fittings
ASME B31.1	(2022) Power Piping
ASME B31.5	(2022) Refrigeration Piping and Heat Transfer Components
ASME B31.9	(2020) Building Services Piping
ASME B40.100	(2022) Pressure Gauges and Gauge Attachments
ASME BPVC SEC IV	(2017) BPVC Section IV-Rules for Construction of Heating Boilers
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC VIII D1	(2019) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1
ASME CSD-1	(2021) Control and Safety Devices for Automatically Fired Boilers

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1001	(2021) Performance Requirements for Atmospheric Type Vacuum Breakers
ASSE 1003	(2020) Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems - (ANSI

	approved 2010)
ASSE 1010	(2021) Performance Requirements for Water Hammer Arresters
ASSE 1011	(2017) Performance Requirements for Hose Connection Vacuum Breakers
ASSE 1012	(2023) Performance Requirements for Backflow Preventer with an Intermediate Atmospheric Vent
ASSE 1013	(2021) Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies
ASSE 1016	(2017) Performance Requirements for Automatic Compensating Valves for individual Showers and Tub/Shower Combinations
ASSE 1017	(2023) Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems - (ANSI approved 2010)
ASSE 1018	(2023) Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied (ANSI Approved 2002
ASSE 1019	(2023) Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance
ASSE 1020	(2020) Performance Requirements for Pressure Vacuum Breaker Assemblies
ASSE 1037	(2015; R 2020) Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures
ASSE 1044	(2023) Performance Requirements for Trap Seal Primer - Drainage Types and Electric Design Types
ASSE 1069	(2020) Performance Requirements for Automatic Temperature Control Mixing Valves
ASSE 1070	(2020) Performance Requirements for Water Temperature Limiting Devices
ASSE 1071	(2012) Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment
ASSE 1072	(2020) Performance Requirements for Barrier Type Trap Seal Protection for Floor Drains

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2017) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2024) Hypochlorites
AWWA B301	(2024) Liquid Chlorine
AWWA C203	(2020) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C606	(2022) Grooved and Shouldered Joints
AWWA C651	(2023) Standard for Disinfecting Water Mains
AWWA C652	(2019) Disinfection of Water-Storage Facilities
AWWA C700	(2020) Cold-Water Meters - Displacement Type, Metal Alloy Main Case
AWWA C701	(2019) Cold-Water Meters - Turbine Type for Customer Service
AWWA D100	(2021) Welded Steel Tanks for Water Storage

AMERICAN WELDING SOCIETY (AWS)

AWS A5.8/A5.8M	(2019) Specification for Filler Metals for Brazing and Braze Welding
AWS B2.2/B2.2M	(2016) Specification for Brazing Procedure and Performance Qualification

ASTM INTERNATIONAL (ASTM)

ASTM A47/A47M	(1999; R 2022; E 2022) Standard Specification for Ferritic Malleable Iron Castings
ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A74	(2021) Standard Specification for Cast Iron Soil Pipe and Fittings
ASTM A105/A105M	(2023) Standard Specification for Carbon Steel Forgings for Piping Applications
ASTM A183	(2014; R 2020) Standard Specification for Carbon Steel Track Bolts and Nuts
ASTM A193/A193M	(2024) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and

	Other Special Purpose Applications
ASTM A515/A515M	(2017; R2022) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service
ASTM A516/A516M	(2017) Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service
ASTM A518/A518M	(1999; R 2022) Standard Specification for Corrosion-Resistant High-Silicon Iron Castings
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A733	(2016; R 2022) Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM A888	(2024) Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B32	(2020) Standard Specification for Solder Metal
ASTM B42	(2020) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B43	(2020) Standard Specification for Seamless Red Brass Pipe, Standard Sizes
ASTM B75/B75M	(2020) Standard Specification for Seamless Copper Tube
ASTM B88	(2022) Standard Specification for Seamless Copper Water Tube
ASTM B88M	(2020) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM B111/B111M	(2024) Standard Specification for Copper and Copper-Alloy Seamless Condenser Tubes and Ferrule Stock
ASTM B117	(2019) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B152/B152M	(2019) Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
ASTM B306	(2020) Standard Specification for Copper Drainage Tube (DWV)
ASTM B370	(2022) Standard Specification for Copper

	Sheet and Strip for Building Construction
ASTM B584	(2022) Standard Specification for Copper Alloy Sand Castings for General Applications
ASTM B813	(2024) Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube
ASTM B828	(2023) Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings
ASTM C564	(2020a) Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1053	(2000; R 2010) Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications
ASTM D638	(2014) Standard Test Method for Tensile Properties of Plastics
ASTM D1004	(2013) Initial Tear Resistance of Plastic Film and Sheeting
ASTM D1248	(2016) Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
ASTM D1785	(2021) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D2000	(2018) Standard Classification System for Rubber Products in Automotive Applications
ASTM D2235	(2004; R 2016) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D2239	(2012) Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
ASTM D2241	(2020) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	(2015) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D2466	(2023) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	(2020) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	(2020) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2657	(2007; R 2015) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D2661	(2014; E 2018) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40, Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2665	(2014) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2672	(2014) Joints for IPS PVC Pipe Using Solvent Cement
ASTM D2683	(2020) Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D2737	(2012a) Polyethylene (PE) Plastic Tubing
ASTM D2846/D2846M	(2019) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems
ASTM D2855	(2020) Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets
ASTM D2996	(2017) Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D3035	(2022) Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
ASTM D3122	(1995; R 2009) Solvent Cements for Styrene-Rubber (SR) Plastic Pipe and Fittings

ASTM D3138	(2004; R 2016) Standard Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
ASTM D3139	(2019) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	(2020) Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3261	(2016) Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D3311	(2017) Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns
ASTM D4101	(2017) Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials
ASTM D4551	(2017) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane
ASTM D4586/D4586M	(2007; R 2018) Asphalt Roof Cement, Asbestos-Free
ASTM E1	(2014) Standard Specification for ASTM Liquid-in-Glass Thermometers
ASTM E96/E96M	(2024) Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials
ASTM F409	(2022) Standard Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings
ASTM F437	(2024) Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F438	(2023) Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40
ASTM F439	(2024) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441/F441M	(2023) Standard Specification for

	Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F442/F442M	(2023) Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)
ASTM F477	(2014; R 2021) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F493	(2022) Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
ASTM F628	(2023) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core
ASTM F877	(2024) Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems
ASTM F891	(2024) Standard Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core
ASTM F1290	(2019) Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings
ASTM F1760	(2016; R 2020) Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F2387	(2021) Standard Specification for Manufactured Safety Vacuum Release Systems (SVRS) for Swimming Pools, Spas, and Hot Tubs
ASTM F2389	(2024a) Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI 301	(2018) Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	(2012) 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	(2016; 14/17) Copper Tube Handbook

CSA GROUP (CSA)

CSA B45.5-17/IAPMO Z124	(2017; Errata 2017; Errata 2018) Plastic Plumbing Fixtures

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

ANSI/IAPMO Z1001	(2021) Standard For Prefabricated Gravity Grease Interceptors
IAPMO PS 117	(2021) Press Connections
IAPMO UPC	(2024) Uniform Plumbing Code
IAPMO Z124.8	(2013 E2; R 2018) Plastic Bathtub Liners

INTERNATIONAL CODE COUNCIL (ICC)

ICC A117.1	(2017) Standard And Commentary Accessible and Usable Buildings and Facilities
ICC IPC	(2024) International Plumbing Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z358.1	(2014; R 2020) American National Standard for Emergency Eyewash and Shower Equipment

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

MSS SP-25	(2018) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-44	(2019) Steel Pipeline Flanges
MSS SP-58	(2018) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-67	(2022) Butterfly Valves
MSS SP-70	(2011) Gray Iron Gate Valves, Flanged and Threaded Ends
MSS SP-71	(2018) Gray Iron Swing Check Valves, Flanged and Threaded Ends
MSS SP-72	(2010a) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-78	(2011) Cast Iron Plug Valves, Flanged and Threaded Ends
MSS SP-80	(2019) Bronze Gate, Globe, Angle and Check Valves

MSS SP-83	(2014) Class 3000 Steel Pipe Unions Socket Welding and Threaded
MSS SP-85	(2011) Gray Iron Globe & Angle Valves Flanged and Threaded Ends
MSS SP-91	(2009) Guidelines for Manual Operation of Valves
MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

NACE INTERNATIONAL (NACE)

NACE SP0169	(2024) Control of External Corrosion on Underground or Submerged Metallic Piping Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2021) Motors and Generators
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 31	(2024; TIA 23-1) Standard for the Installation of Oil-Burning Equipment
NFPA 54	(2024) National Fuel Gas Code
NFPA 90A	(2024) Standard for the Installation of Air Conditioning and Ventilating Systems

NSF INTERNATIONAL (NSF)

NSF 372	(2022) Drinking Water System Components - Lead Content
NSF/ANSI 14	(2023) Plastics Piping System Components and Related Materials
NSF/ANSI/CAN 61	(2022) Drinking Water System Components - Health Effects

PLASTIC PIPE AND FITTINGS ASSOCIATION (PPFA)

PPFA Fire Man	(2016) Firestopping: Plastic Pipe in Fire Resistive Construction

PLUMBING AND DRAINAGE INSTITUTE (PDI)

PDI WH 201	(2010) Water Hammer Arresters Standard

POOL & HOT TUB ALLIANCE (PHTA)

ANSI/APSP-16	(2017) American National Standard for Suction Outlet Fitting Assemblies (SOFA) for Use in Pools, Spas and Hot Tubs

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE J1508	(2023) Hose Clamp Specifications

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SM 9223	(2004) Enzyme Substrate Coliform Test
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
21 CFR 175	Indirect Food Additives: Adhesives and Components of Coatings
40 CFR 141.80	National Primary Drinking Water Regulations; Control of Lead and Copper; General Requirements

UL SOLUTIONS (UL)

UL 174	(2004; Reprint Oct 2023) UL Standard for Safety Household Electric Storage Tank Water Heaters
UL 399	(2017; Reprint May 2019) UL Standard for Safety Drinking Water Coolers
UL 430	(2015; Reprint Sep 2021) UL Standard for Safety Waste Disposers
UL 499	(2014; Reprint May 2023) UL Standard for Safety Electric Heating Appliances
UL 732	(2023) UL Standard for Safety Oil-Fired Storage Tank Water Heaters
UL 1951	(2011; Reprint Jun 2020) UL Standard for Safety Electric Plumbing Accessories

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions

in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified 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 Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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 and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

****

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

****

NOTE: Use SD-02 for specialty items or non everyday type systems.

****

SD-02 Shop Drawings

Plumbing System; G, [_____]

SD-03 Product Data

Backflow Prevention Assemblies; G, [_____]

****

NOTE: The following submittals are tailored for PIPING. Use of press fittings to be verified if allowed on project.

****

Recycled Content for Steel Pipe; S

Recycled Content for Cast Iron Pipe; S

Swimming Pool [and Spa]Suction Fittings; G, [_____]

[Press Fittings; G, [_____]

] **
NOTE: The following submittals are tailored for FIXTURES.
****

Fixtures

Shower Faucets; G, [_____]

Flush Valve Water Closets

WaterSense Label for Flush Valve Water Closet; S

Flush Valve Urinals

WaterSense Label for Urinal; S

Flush Tank Water Closets

WaterSense Label for Flush Tank Water Closet; S

Wall Hung Lavatories

Countertop Lavatories

WaterSense Label for Lavatory Faucet; S

Kitchen Sinks

Service Sinks

Drinking-Water Coolers; G, [_____]

Energy Star Label for Freestanding Bottled Water Coolers/Dispensers; S

WaterSense Label for Showerhead; S

Plastic Bathtubs

Plastic Shower Stalls

Plastic Bathtub Liners

Plastic Bathtub Wall Surrounds

Washfountains

****
NOTE: The following three submittals are tailored for WATER HEATERS.
****

Water Heaters; G, [_____]

Energy Star Label for Gas Storage Water Heater; S

Energy Star Label for Gas Instantaneous Water Heater; S

****
NOTE: The following two submittals are tailored for PUMPS.
****

Pumps; G, [_____]

Pool Water Pump Safety Vacuum Release System; G, [_____]

Welding

Vibration-Absorbing Features; G, [_____]

Plumbing System

Thermostatic Mixing Valves

Temperature Controlled Mixing Valve

Point-Of-Use Mixing Valve

Automatic Temperature And/Or Pressure Compensating Valve

Temperature Actuated Mixing Valve

Single Supply Line Automatic Temperature Control

SD-06 Test Reports

Tests, Flushing and Disinfection

Test of Backflow Prevention Assemblies; G, [_____].

SD-07 Certificates

Materials and Equipment

Bolts

SD-10 Operation and Maintenance Data

Plumbing System; G, [_____]

1.3 SHOP DRAWINGS

****
NOTE: The following paragraph contains tailoring for PIPING.
****

Submit Plumbing System Detail drawings consisting of schedules, performance charts, instructions, diagrams, and other information to

illustrate the requirements and operations of systems that are not covered by the Plumbing Code. Submit Plumbing System 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 must indicate clearances required for maintenance and operation. Where piping and equipment are to be supported other than as indicated, details must include loadings and proposed support methods. Mechanical drawing plans, elevations, views, and details, must be drawn to scale.

1.4 STANDARD PRODUCTS

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

Where equipment is specified to conform to requirements of the ASME Boiler and Pressure Vessel Code, the design, fabrication, and installation must conform to the code and a certificate must be submitted for the equipment.

1.4.1 Alternative Qualifications

Products having less than a 2-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.

1.4.2 Service Support

The equipment items must 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 must 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.

1.4.3 Manufacturer's Nameplate

Each item of equipment must 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.

1.4.4 Modification of References

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" 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.

1.4.4.1 Definitions

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

1.4.4.2 Administrative Interpretations

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, must be applied appropriately by the Contracting Officer as authorized by his administrative cognizance and the FAR.

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 PERFORMANCE REQUIREMENTS

1.6.1 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.

The following paragraph contains tailoring for PIPING and ARMY.

****

[Piping must be welded in accordance with qualified procedures using performance-qualified welders and welding operators. Submit a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators. Procedures and welders must be qualified 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 B31.9, unless temperature and pressure limits specified then may be accepted as permitted by ASME B31.1. The Contracting Officer must be notified 24 hours in advance of tests, and the tests must be performed at the work site if practicable. Welders or welding operators must apply their assigned symbols near each weld they make as a permanent record. Structural members must be welded in accordance with Section 05 05 23.16 STRUCTURAL WELDING.][Welding and nondestructive testing procedures are

specified in Section 40 05 13.96 WELDING PROCESS PIPING.]

1.6.2 Cathodic Protection and Pipe Joint Bonding

****
NOTE: The following paragraph contains tailoring for ARMY and NAVY.
****

Cathodic protection and pipe joint bonding systems must be in accordance with [Section 26 42 13 GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM][and][Section 26 42 17 IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) SYSTEM]

??? [Section 26 42 13 GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM][and][Section 26 42 17 IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) SYSTEM].

1.7 REGULATORY REQUIREMENTS

Unless otherwise required herein, plumbing work must be in accordance with ICC IPC.

1.8 PROJECT/SITE CONDITIONS

The Contractor must become familiar with details of the work, verify dimensions in the field, and advise the Contracting Officer of any discrepancy before performing any work.

1.9 INSTRUCTION TO GOVERNMENT PERSONNEL

Furnish 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 must be thoroughly familiar with all parts of the installation and must be trained in operating theory as well as practical operation and maintenance work. Submit Plumbing System Operation and Maintenance Data in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

Instruction must 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 must 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. 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.

1.10 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, designer's 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, expansion joints, controls, dampers, and equipment requiring access, in locations freely accessible through access doors.

PART 2 PRODUCTS

2.1 MATERIALS

****
NOTE: Some materials listed are superior to others for specific requirements. Therefore, information should be obtained from the Installation Department of Public Works or Base Civil Engineer for any special requirements before selection of material is made. The type of tubing or pipe required will be as determined by local experience.

Preference must be given to the following materials for waste pipe: 100 percent recycled content cast iron, minimum 25 percent recycled content PVC, and ABS drain pipe. Preference must be given, in this order, to the following materials for supply pipe: copper, galvanized steel, polyethylene pipe, polypropylene, and PVC.

If PEX is used, tube I.D. sizes are to be copper equivalent I.D. sizes. (PEX is not to be used on Navy, Marine Corps and Air Force projects.)

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.

Push on type fittings must not be used.

Manufacturer to provide references for successful installation currently in service.
****

****
NOTE: Nonpressure pipe is an EPA designated product for recycled content. Use materials with recycled content where appropriate for use. Designer must verify suitability, availability within the region, cost effectiveness and adequate competition before specifying product recycled content requirements. A resource that can be used to identify products with recycled content is the "Comprehensive Procurement Guidelines (CPG)" page within the EPA's website at https://www.epa.gov/. Other products with recycled

content are also acceptable when meeting all requirements of this specification.

****

****

NOTE: The following paragraph contains tailoring for PIPING and NAVY.

****

Materials for various services must be in accordance with TABLES I and II. Cement pipe must contain recycled content as specified in Section 03 30 00 CAST-IN-PLACE CONCRETE. Steel pipe must contain a minimum of 25 percent recycled content, with a minimum of 16 percent post-consumer recycled content. Provide data identifying percentage of recycled content for steel pipe. Pipe schedules must be selected based on service requirements. Pipe fittings must be compatible with the applicable pipe materials. Plastic pipe, fittings, and solvent cement must meet NSF/ANSI 14 and must be NSF listed for the service intended. Plastic pipe, fittings, and solvent cement used for potable hot and cold water service must bear the NSF seal "NSF-PW." Polypropylene pipe and fittings must conform to dimensional requirements of Schedule 40, Iron Pipe size and must comply with NSF/ANSI 14, NSF/ANSI/CAN 61 and ASTM F2389. Polypropylene piping that will be exposed to UV light must be provided with a Factory applied UV resistant coating. Pipe threads (except dry seal) must conform to ASME B1.20.1. Grooved pipe couplings and fittings must be from the same manufacturer. Material or used in any potable water system intended for human consumption be certified in accordance with NSF 372 with the exception of brazing materials. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers must comply with PL 93-523 and NSF/ANSI/CAN 61, Section 8. End point devices such as drinking water fountains, lavatory faucets, kitchen and bar faucets, residential ice makers, supply stops and end point control valves used to dispense water for drinking must meet the requirements of NSF/ANSI/CAN 61, Section 9. Hubless cast-iron soil pipe must not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors (for Air Force/Army/Navy projects). Cast-iron pipe must contain a minimum of 95 percent recycled content. Provide data identifying percentage of recycled content for cast iron pipe. Plastic pipe must not be installed in air plenums. Plastic pipe must not be installed in a pressure piping system in buildings greater than three stories including any basement levels.

2.1.1 Pipe Joint Materials

****

NOTE: The following paragraphs are tailored for PIPING.

****

Grooved pipe and hubless cast-iron soil pipe must not be used underground. Solder containing lead must not be used with copper pipe. Cast iron soil pipe and fittings must be marked with the collective trademark of the Cast Iron Soil Institute. Joints and gasket materials must 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 B584].

d. Flange Gaskets: Gaskets must be made of non-asbestos material in accordance with ASME B16.21. Gaskets must 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 must be the full face or self centering flat ring type. Gaskets used for hydrocarbon service must be bonded with NBR.

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

f. Brazing Flux: Flux must be in paste or liquid form appropriate for use with brazing material. Flux must 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 must conform to ASTM B32.

h. Solder Flux: Flux must be liquid form, non-corrosive, and conform to ASTM B813, Standard Test 1.

****

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

****

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 F477.

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

n. Solvent Cement for Transition Joints between ABS and PVC Nonpressure Piping Components: ASTM D3138.

o. Plastic Solvent Cement for ABS Plastic Pipe: ASTM D2235.

p. Plastic Solvent Cement for PVC Plastic Pipe: ASTM D2564 and ASTM D2855.

q. Plastic Solvent Cement for CPVC Plastic Pipe: ASTM F493.

r. Flanged fittings including, but not limited to, flanges, bolts, nuts and bolt patterns must be in accordance with ASME B16.5 class 150 and must have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material must conform to ASTM A105/A105M. Blind flange material must conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts must 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.

s. Plastic Solvent Cement for Styrene Rubber Plastic Pipe: ASTM D3122.

****
NOTE: For Navy, Marine Corps, and Army projects, coordinate with the Department of Public Works or Base Civil Engineer on the use of press fittings for copper pipe and tube.
****

[t. Press fittings for Copper Pipe and Tube: Copper press fittings must conform to the material and sizing requirements of ASME B16.51 and performance criteria of IAPMO PS 117. Sealing elements for copper press fittings must be EPDM, FKM or HNBR. Sealing elements must be factory installed or an alternative supplied fitting manufacturer. Sealing element must be selected based on manufacturer's approved application guidelines. Provide manufacturer data to show product has been installed on multiple projects of similar type.

] u. Copper tubing must conform to ASTM B88M ASTM B88, Type K, L or M.

v. Heat-fusion joints for polypropylene piping: ASTM F2389.

2.1.2 Miscellaneous Materials

Miscellaneous materials must conform to the following:

****
The following list contains tailoring: Items a., h., i., and j. are tailored for PIPING; Items e., f., and g. are tailored for FIXTURES.
****

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

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

c. Asphalt Roof Cement: ASTM D4586/D4586M.

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 must 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 and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

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

2.1.3 Pipe Insulation Material

****
NOTE: The following paragraph is tailored for PIPING.
****

Insulation must be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS.

2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

****
NOTE: The following paragraph is tailored for PIPING.
****

Pipe hangers, inserts, and supports must conform to MSS SP-58.

2.3 VALVES

****
NOTE: The list below contains tailoring: Items a. and b. are tailored for FIXTURES; Item c. is tailored for WATER HEATERS.

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.

d. In nonfreezing climates, wall faucets will be installed on outside walls and lawn faucets in parking, garden, and lawn areas. In freezing climates, freezeproof wall hydrants will be installed on outside walls and yard hydrants in parking, garden, and lawn areas. Indicate on the drawings height of hydrants and faucets above finished grade.
****

****

NOTE: The following paragraph contains tailoring for PIPING.

Select the bracketed option to ensure large manually operated valves can be operated by hand without aid of additional mechanical leverage. Especially applicable for valves with high seating torque such as resilient seat wedge gate valves.

****

Valves must be provided on supplies to equipment and fixtures. Valves 65 mm 2-1/2 inches and smaller must be bronze with threaded bodies for pipe and solder-type connections for tubing. Valves 80 mm 3 inches and larger must have flanged iron bodies and bronze trim. Pressure ratings must 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.[Valve actuators for manually operated valves 300 mm 12 inches and larger must be sized and provided by manufacturer assuming the standard operator input forces listed in MSS SP-91.]" Valves must 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: Requirements for Potable-Water Heaters Bottom Drain Valve
Trap Seal Primer Valves	ASSE 1018
Temperature and Pressure Relief Valves for Hot Water Supply Systems	ANSI Z21.22/CSA 4.4
Temperature and Pressure Relief Valves for Automatically Fired Hot Water Boilers	ASME CSD-1 Safety Code No., Part CW, Article 5

2.3.1 Backwater Valves

****
NOTE: The following paragraph is tailored for PIPING.
****

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

2.3.2 Wall Faucets

****
NOTE: The following paragraph is tailored for PIPING.
****

Wall faucets with vacuum-breaker backflow preventer must be brass with 20 mm 3/4 inch male inlet threads, hexagon shoulder, and 20 mm 3/4 inch hose connection. Faucet handle must be securely attached to stem.

2.3.3 Wall Hydrants (Frostproof)

****
NOTE: In locations where the design temp is 32 degrees F 0 degrees C or less provide Freezeproof will hydrants.
****

ASSE 1019 with vacuum-breaker backflow preventer must have a[nickel-brass or nickel-bronze wall plate and flange with nozzle and detachable key handle][recessed box, with locking cover]. A brass or bronze operating rod must be provided 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. A brass or bronze valve with coupling and union elbow having metal-to-metal seat must be provided. Valve rod and seat washer must be removable through the face of the hydrant. The hydrant must have 20 mm 3/4 inch exposed hose thread on spout and 20 mm 3/4 inch male pipe thread on inlet.

2.3.4 Lawn Faucets

****
NOTE: The following paragraph is tailored for PIPING.
****

Lawn faucets must be brass, with either straight or angle bodies, and must be of the compression type. Body flange must be provided with internal pipe thread to suit 20 mm 3/4 inch pipe. Body must be suitable for wrench grip. Faucet spout must have 20 mm 3/4 inch exposed hose threads. Faucet handle must be securely attached to stem.

2.3.5 Yard Hydrants

Yard box or post hydrants must have valve housings located below frost lines. Water from the casing must be drained after valve is shut off. Hydrant must be bronze with cast-iron box or casing guard. "T" handle key must be provided.

2.3.6 Outlet Boxes

2.3.6.1 Washer Box

One-piece, recessed,[high-impact plastic][metal] box with quarter turn shut-off valves,[water hammer arresters] 12.7 mm 1/2 inch hot and cold supplies, 50.8 mm 2 inch drain.

2.3.6.2 Ice Maker Box

One-piece, recessed,[high impact plastic][metal] box with quarter turn shut-off valves, 12.7 mm 1/2 inch supply.

2.3.7 Relief Valves

****
NOTE: The following paragraph is tailored for WATER HEATERS.
****

Water heaters and hot water storage tanks must have a combination pressure and temperature (P&T) relief valve. The pressure relief element of a P&T relief valve must 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 must have a relieving capacity which is at least equal to the total input of the heaters when operating at their maximum capacity. Relief valves must 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 must 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 must have 25 mm 1 inch minimum inlets, and 25 mm 1 inch outlets. The discharge pipe from the relief valve must be the size of the valve outlet.

2.3.8 Thermostatic Mixing Valves

****

NOTE: For combination potable water heating and space heating systems, see UFC 3-420-01 Section 501.2.

****

Each valve must be constructed to control the mixing of hot and cold water and to deliver water at a desired temperature regardless of pressure or input temperature changes. The control element must be of an approved type. The body must be of heavy cast bronze, and interior parts must be brass, bronze, corrosion-resisting steel or copper. The valve must be equipped with necessary stops, check valves, unions, and sediment strainers on the inlets.

2.3.9 Temperature Controlled Mixing Valve

Provide an ASSE 1017 temperature controlled (master mixing valve) to lower temperature per UFC 3-420-01 immediately downstream of the water heater [and][or] storage tank as close to the fixture(s) as possible in order to reduce the amount of stored tempered water in the pipes in accordance with ASSE 1017.

2.3.10 Point-of-Use Mixing Valve

Provide a point-of-use mixing valve in accordance with ASSE 1070 at lavatories, hand-wash sinks, and washfountain locations. Point-of-use mixing valve must limit the tempered water to not greater than 43.4 degrees C 110 degrees F.

2.3.11 Automatic Temperature [and][or] Pressure Compensating Valve

Provide automatic temperature and/or pressure compensating valve installed at each individual shower or tub/shower combination in accordance with ASSE 1016. The compensating valve must be integrated with each individual shower or tub/shower combination valve and must be installed at point of use. The valve must be equipped with a device to limit the maximum temperature to 48.9 degrees C 120 degrees F.

2.3.12 Temperature Actuated Mixing Valve

Provide ASSE 1071 temperature actuated mixing valve to provide tepid water for emergency eyewash, shower/eyewash, drench shower and combination units that comply with ANSI/ISEA Z358.1. Valves must have a means to limit the maximum outlet temperature and must include a means of preventing cross-flow. Valves can be located[in a wall-mounted bracket][in a cabinet][in a cabinet with window].

2.3.13 Single Supply Line Automatic Temperature Control

Provide ASSE 1069 automatic temperature control valve on single supply line to gang showers or sitz baths to provide tempered water control to multiple fixtures. Valves must be installed where end user does not have means to adjust temperature setting. Temperature setting must be set as indicated with a maximum set point of 48.9 degrees C 120 degrees F.

2.4 FIXTURES

****
NOTE: This SUBPART is tailored for FIXTURES.
****

****
NOTE: For NAVFAC Mid-Atlantic and Newport, R.I. use copper alloy bathtub waste drains.
****

****
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 must be life-cycle cost-effective. Low-flow and zero-flow fixtures and accessories (such as no-water urinals, composting toilets, 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 QUALITY CONTROL.
****

****
NOTE: 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.
****

Submit list of fixtures with manufacturer, model, and flow rate. Water closet replacements in major renovations may have a flush valve of up to 6.1 LPF 1.6 GPF to accommodate existing plumbing capacity. Fixtures for use by the physically handicapped must be in accordance with ICC A117.1.[ASME A112.19.3/CSA B45.4 302 stainless steel] [Vitreous China], nonabsorbent, hard-burned, and vitrified throughout the body must be provided. Porcelain enameled ware must have specially selected, clear [white][_____], acid-resisting enamel coating evenly applied on surfaces.

No fixture will be accepted that shows cracks, crazes, blisters, thin spots, or other flaws. Fixtures must be equipped with appurtenances such as traps, faucets, stop valves, and drain fittings. Each fixture and piece of equipment requiring connections to the drainage system, except grease interceptors, must be equipped with a trap. Brass expansion or toggle bolts capped with acorn nuts must be provided for supports, and polished chromium-plated pipe, valves, and fittings must be provided where exposed to view. Fixtures with the supply discharge below the rim must be equipped with backflow preventers. Internal parts of flush valves and flushometer valves, shower mixing valves, shower head face plates, pop-up stoppers of lavatory waste drains, and pop-up stoppers and overflow tees and shoes of bathtub waste drains [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][must be copper alloy with all visible surfaces chrome plated].[Plastic in contact with hot water must be suitable for 82 degrees C 180 degrees F water temperature.]

2.4.1 Lavatories

****

NOTE: This paragraph is tailored for ARMY. Lavatories installed in male barracks or dormitories and in male gang toilets (three or more water closets) or other types of buildings should be provided with brackets to prevent uplifting. In central toilets allow only enameled cast-iron lavatories.

****

[Enameled cast-iron lavatories must be provided with two cast-iron or steel brackets secured to the underside of the apron and drilled for bolting to the wall in a manner similar to the hanger plate. Exposed brackets must be porcelain enameled.][Vitreous china lavatories must be provided with two integral molded lugs on the back-underside of the fixture and drilled for bolting to the wall in a manner similar to the hanger plate.][Provide public faucet with a maximum flow rate of 1.9 L/min 0.5 gpm at a maximum flowing pressure of 414 kPa 60 psi.][Provide WaterSense labeled private faucet with a maximum flow rate of 5.7 L/min 1.5 gpm and a minimum flow rate of 3 L/min 0.8 gpm at a maximum flowing pressure of 414 kPa 60 psi.][Provide WaterSense labeled metering faucet with a maximum flow rate of 1.0 L 0.25 gal per metering cycle.]Provide data identifying WaterSense label for lavatory faucet.

[2.4.2 Automatic Controls

****

NOTE: This paragraph contains tailoring for NAVY. Include this paragraph only if automatic controls is a project requirement. Use photovoltaic cells or hydropower generators to extend sensor battery life. This should be discussed with the user and an automatic control specified if requested by the user. If using battery operated, sensor activated valves, ensure approval from user or maintenance personnel for the replacing and maintaining batteries on the controls.

****

Provide[hard wired][battery operated] automatic, sensor operated faucets and flush valves to comply with ASSE 1037 and UL 1951 for lavatory faucets, urinals, and water closets. Flushing and faucet systems must consist of solenoid-activated valves with light beam sensors. Flush valve for water closet must include an override pushbutton. Flushing devices must be provided as described in paragraph FIXTURES AND FIXTURE TRIMMINGS.

]2.4.3 Flush Valve Water Closets

2.4.3.1 Flush Valve Water Closet Type and Mount

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 Stainless Steel,] siphon jet,[elongated][round] bowl,[floor-mounted, floor outlet][wall mounted, wall outlet, provide with carrier]. Top of toilet seat height above floor must be 356 to 381 mm 14 to 15 inches, except 432 to 483 mm 17 to 19 inches for wheelchair water closets. Provide wax bowl ring including plastic sleeve. Provide [white][_____] solid plastic[elongated][round][open-front seat][closed-front seat with cover].

2.4.3.2 Flush Valve Water Closet Flush and Flow

Water flushing volume of the water closet and flush valve combination must not exceed 4.85 liters 1.28 gallons per flush.[Provide a dual-flush water closet and flush valve combination that will also provide a second flushing water volume not to exceed 4.8 liters 1.28 gallons per flush.] Water closets must meet the EPA WaterSense product definition and must be EPA WaterSense labeled products. Provide data identifying WaterSense label for flush valve water closet. Fixtures that require the WaterSense label but are located in countries where the label is unavailable, see table below or see https://uwla.eu/for WaterSense label substitutes.

WaterSense Equivalencies	
Australia	WELs
Canada	WaterSense

Non-Mandatory Labels*	
European Union	European Water Label
Taiwan	Water Saving Label
China, Hong Kong	WELS

*Water efficiency labels recognized as market transformational, and are recommended, but not required for LEED projects.

2.4.3.3 Flush Valve Water Closet Control Valve

Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components must be chromium-plated or polished stainless steel. Flush valves must be nonhold-open type. Mount flush valves not less than 279 mm 11 inches above the fixture. Mounted height of flush valve must not

interfere with the hand rail in ADA stalls.[Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.]

2.4.4 Flush Valve Urinals

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china, [ASME A112.19.3/CSA B45.4 302 stainless steel,] wall-mounted, wall outlet, siphon jet, integral trap, and extended side shields. Provide urinal with the rim 610 mm 24 inches above the floor. Water flushing volume of the urinal and flush valve combination must not exceed 1.9 liters 0.5 gallons per flush. Urinals must be EPA WaterSense labeled products. Provide data identifying WaterSense label for urinal. Fixtures that require the WaterSense label but are located in countries where the label is unavailable, see table below or see https://uwla.eu/for WaterSense label substitutes.

WaterSense Equivalencies	
Australia	WELs
Canada	WaterSense

Non-Mandatory Labels*	
European Union	European Water Label
Taiwan	Water Saving Label
China, Hong Kong	WELS

*Water efficiency labels recognized as market transformational, and are recommended, but not required for LEED projects.

Provide ASME A112.6.1M concealed chair carriers with vertical steel pipe supports. Provide large diameter flush valve including angle control-stop valve, vacuum breaker, tail pieces, slip nuts, and wall plates; exposed to view components must be chromium-plated or polished stainless steel. Flush valves must be nonhold-open type. Mount flush valves not less than 279 mm 11 inches above the fixture.[Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.]

2.4.5 Wheelchair Flush Valve Type Urinals

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 stainless steel,] wall-mounted, wall outlet, blowout action, integral trap, elongated projecting bowl, a minimum of 343 mm 13.5 inches long from wall to front of flare, and ASME A112.19.5 trim. Provide large diaphragm (not less than 66 mm 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), nonhold-open flush valve of chrome plated cast brass conforming to ASTM B584, including vacuum breaker and angle (control-stop) valve with back check. The water flushing volume of the flush valve and urinal combination must not exceed 1.9 liters 0.5 gallon per flush. Urinals must be EPA WaterSense labeled products. Provide data

identifying WaterSense label for wheelchair flush valve urinal. Fixtures that require the WaterSense label but are located in countries where the label is unavailable, see table below or see https://uwla.eu/for WaterSense label substitutes.

WaterSense Equivalencies	
Australia	WELs
Canada	WaterSense

Non-Mandatory Labels*	
European Union	European Water Label
Taiwan	Water Saving Label
China, Hong Kong	WELS

*Water efficiency labels recognized as market transformational, and are recommended, but not required for LEED projects.

Furnish urinal manufacturer's certification of conformance. Provide ASME A112.6.1M concealed chair carriers. Mount urinal with front rim a maximum of 432 mm 17 inches above floor and flush valve handle a maximum of 1118 mm 44 inches above floor for use by handicapped on wheelchair.[Provide solenoid-activated flush valves including electrical-operated light-beam-sensor to energize the solenoid.]

2.4.6 No-Water Urinals

****

NOTE: This paragraph is tailored for NAVY and AIR FORCE. Use the following paragraph for Navy and Air Force projects only. Confirm selection with Installation Department of Public Works/Base Civil Engineer.

****

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 stainless steel,] wall-mounted, wall outlet. Provide with urine trap and 100 percent biodegradable sealant liquid as approved by manufacturer.[For ADA, provide urinal with the rim 430 mm 17 inches above the floor.][For non-ADA, provide urinal with the rim 609.6 mm 24 inches above the floor.] Provide ASME A112.6.1M concealed chair carriers.

2.4.7 Non-Water Use Urinals

****

NOTE: This paragraph is tailored for ARMY. Use the following paragraph for Army projects only. For FY10 and beyond MILCON projects, Army Installation Design Standard requires the use of non-water using urinals for new construction and major repairs. Confirm selection with Installation Department of

Public Works/Base Civil Engineer.

****

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 stainless steel,] wall-mounted, wall outlet, non-water using, integral drain line connection. The trap design must comply with the IPC. Sealed replaceable cartridge or integral liquid seal trap must use a biodegradable liquid to provide the seal and maintain a sanitary and odor-free environment. Install with urinal rim 610 mm 24 inches above the floor. Urinals installed in compliance with ADA requirements must be mounted with the rim 430 mm 17 inches above the floor. Provide ASME A112.6.1M concealed chair carriers. Installation, maintenance and testing must be in accordance with the manufacturer's recommendations. Slope the sanitary sewer branch line for non-water use urinals a minimum of 6.35 mm per meter 0.25 inches per foot. Drain lines that connect to the urinal outlet must not be made of copper tube or pipe. For urinals that use a replaceable cartridge, provide four additional cartridges for each urinal installed along with any tools needed to remove/install the cartridge. Provide an additional quart of biodegradable liquid for each urinal installed. Manufacturer must provide an operating manual and on-site training for the proper care and maintenance of the urinal.

2.4.8 Flush Tank Water Closets

****

NOTE: Dual-flush toilets allow the user to choose the flush rate needed for each use instead of flushing at maximum capacity every time.

****

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 stainless steel,] siphon jet,[round bowl,][pressure assisted,] floor-mounted, floor outlet. Top of toilet seat height above floor must be 356 to 381 mm 14 to 15 inches, except 432 to 483 mm 17 to 19 inches for wheelchair water closets.[Nonfloat swing type flush tank valves are not acceptable.][Gravity tank type water closets are not permitted.] Provide wax bowl ring including plastic sleeve. Water flushing volume of the water closet must not exceed 4.8 liters 1.28 gallons per flush.[Provide a dual-flush toilet with a second flushing option that must not exceed 4.1 liters 1.1 gallons per flush.] Tank-type water closets must be EPA WaterSense labeled products. Provide data identifying WaterSense label for flush tank water closet. Fixtures that require the WaterSense label but are located in countries where the label is unavailable, see table below or see https://uwla.eu/for WaterSense label substitutes.

WaterSense Equivalencies	
Australia	WELs
Canada	WaterSense

Non-Mandatory Labels*	
European Union	European Water Label
Taiwan	Water Saving Label
China, Hong Kong	WELS

*Water efficiency labels recognized as market transformational, and are recommended, but not required for LEED projects.

Provide [white][_____] solid plastic[round][elongated][open-front][closed-front] seat with cover.

2.4.9 Non-Flushing Toilets

****
NOTE: Composting toilets reduce water usage and create soil amendment. Electric fans, mixing tines, and electric heat accelerate decomposition, although electric heat is energy intensive. Vacuum toilet systems, traditionally associated with water conservation in marine, air, and railroad transports are also available for application in commercial/residential buildings. Vacuum toilets not only reduce water consumption, but they reduce piping and can eliminate need for toilet vent pipes, allowing for flexibility in design layout.
****

[Provide composting toilets in accordance with manufacturer's recommendations.][Provide vacuum toilet systems in accordance with manufacturer's recommendations.]

2.4.10 Wall Hung Lavatories

****
NOTE: This paragraph contains tailoring for AIR FORCE.
****

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 stainless steel,][straight back][ledge back][corner] type, minimum dimensions of [483 mm wide by 432 mm][407 mm wide by 407 mm] [19 inches wide by 17 inches][16 inches wide by 16 inches] front to rear, with supply openings for use with top mounted centerset faucets, and openings for concealed arm carrier installation.[Provide aerator with faucet.] Provide lavatory faucets and accessories meeting the flow rate and product requirements of the paragraph LAVATORIES. 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 864 mm 34 inches above floor and with 737 mm 29 inches minimum clearance from bottom of the front rim to floor.[Provide top mounted washerless centerset lavatory faucets.][Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.][Provide filters for chlorine in supply piping to faucets.] Provide piping covers for P-traps, valves, and exposed drain piping per ADA requirement.

2.4.11 Countertop Lavatories

****
NOTE: This paragraph contains tailoring for AIR FORCE
****

ASME A112.19.2/CSA B45.1,[self-rimming][under-counter mount][white][_____] vitreous china,[ASME A112.19.3/CSA B45.4 302 stainless steel], minimum dimensions of 483 mm wide by 432 mm 19 inches wide by 17 inches front to rear, with supply openings for use with top mounted centerset faucets. Furnish template and mounting kit by lavatory manufacturer.[Provide aerator with faucet.]Provide lavatory faucets and accessories meeting the flow rate and product requirements of the paragraph LAVATORIES. Mount counter with the top surface 864 mm 34 inches above floor and with 737 mm 29 inches minimum clearance from bottom of the counter face to floor.[Provide top mounted washerless centerset lavatory faucets.][Provide top-mounted solenoid-activated lavatory faucets including electrical-operated light-beam-sensor to energize the solenoid.][Provide filters for chlorine in supply piping to faucets.]

2.4.12 Washfountains

ASME A112.19.3/CSA B45.4 and ASME A112.18.1/CSA B125.1. Provide[wall-mounted][floor-supported], [3][4][5][8] User[accessible,][vandal-resistant,][circular][semi-circular][corner] washfountain. Constructed of[solid surface material][reinforced thermoset polyester][precast terrazzo][stainless steel][recycled solid surface material]. Unit to include individual spray heads per station with flow rate of 1.89 L/min .5 GPM, ASSE 1070 mixing valve, volume control valve, waste and supply connections with stops, strainers, and check valves. Operation to be[foot control][hand control pushbutton][infrared sensor operation]. Unit height to be [711][737][864] mm [28][29][34] inches.[Provide with stainless steel overhead shroud].

2.4.13 Lavatory Systems, Single or Multiple Stations

ASME A112.18.1/CSA B125.1, provide wall hung, solid surface counter with integral bowls and 410 mm 16-1/8 inches access panel. Provide with[one][two][three][four] bowls. Height to rim dimensions [864 mm 34 inches][_____], provide manufacturer's standard, chrome plated solid brass faucet at each bowl with[manual, push button][hard wired, sensor activated][battery powered, sensor activated] control. Provide ASSE 1070 point-of-use mixing valve with check stops per[single][multiple] user station, set to maximum 43.3 degrees C 110 degrees F.[Provide integral hand dryer.][Provide integral soap dispenser.]

2.4.14 Kitchen Sinks

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

NOTE: This paragraph contains tailoring for AIR FORCE.
****

ASME A112.19.3/CSA B45.4,[single][double][triple] compartment, 20 gage stainless steel with integral mounting rim for flush installation, minimum dimensions of [762 mm wide by 534 mm][838 mm wide by 533 mm][1600 mm wide by 534] [30 inches wide by 21 inches][33 inches wide by 21 inches][63 inches wide by 21 inches] front to rear, with undersides fully sound deadened, with supply openings for use with top mounted washerless sink faucets with hose spray, and with 89 mm 3.5 inch drain outlet.[Provide aerator with faucet.] Water flow rate must not exceed 8.3 L per minute 2.2 gpm when measured at a flowing water pressure of 414 kPa 60 psi. Provide stainless steel drain outlets and stainless steel cup strainers. Provide separate 38 mm 1.5 inch P-trap and drain piping to vertical vent piping from each compartment. Provide top mounted washerless sink faucets with hose spray.[Provide filters for chlorine in supply piping to faucets.][Provide UL 430 waste disposer in right compartment.][Provide pedal valve for foot-operated flow control.][Provide secondary kitchen sink that drains to graywater system.][Provide sink with disposal chute to compost bucket under sink.]

2.4.15 Service Sinks

ASME A112.19.2/CSA B45.1, [white][_____] vitreous china [ASME A112.19.3/CSA B45.4 302 stainless steel] 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 0.75 inch external hose threads.

2.4.16 Drinking-Water Coolers for Standing Person

****
NOTE: This paragraph contains tailoring for AIR FORCE.
****

ANSI/ASHRAE 18, UL 399, NSF/ANSI/CAN 61, ADA and ICC A117.1. Dual or Bi-Level water coolers to conform to the requirements of DRINKING-WATER COOLER FOR STANDING PERSON and WHEELCHAIR DRINKING WATER COOLER conforming to ICC A117.1, ANSI/ASHRAE 18, UL 399, NSF/ANSI/CAN 61. Wall mounted height water cooler 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, 8.4 ml per second 8 gph minimum capacity, stainless steel splash receptor and basin,[bottle filler,][vandal resistant,][touchless control,][filter,] and stainless steel cabinet. Bubblers must be controlled by push levers or push bars, front mounted or side mounted near the front edge of the cabinet. Bubbler spouts must be mounted at maximum of 965 mm to 1092 mm 38 inches to 43 inches above floor. Spouts must direct water flow at least 102 mm 4 inches above unit basin and trajectory parallel or nearly parallel to the front of unit.[Provide filters for chlorine in supply piping to faucets.] Provide ASME A112.6.1M concealed steel pipe chair carriers.

2.4.17 Wheelchair Drinking Water Cooler

****
NOTE: Use 4.99 ml per second 4.75 gph minimum capacity for single height water cooler and 8.4 ml per second 8 gph minimum capacity for dual height

water cooler.

This paragraph contains tailoring for AIR FORCE.
****

ANSI/ASHRAE 18, UL 399, NSF/ANSI/CAN 61, ADA and ICC A117.1. [Single][and][Dual] height water cooler with more than a single thickness of metal between the potable water and the refrigerant in the heat exchanger, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, [4.99 mL per second 4.75 gph minimum capacity][and][8.4 ml per second 8 gph minimum capacity], stainless steel splash receptor, and all stainless steel cabinet, with 686 mm 27 inch minimum knee clearance from front bottom of unit to floor and 914 mm 36 inch maximum spout height above floor for ADA side and 965 mm to 1092 mm 38 inches to 43 inches above floor for standing person side[and bottle filler][vandal resistant][touchless control][filter][cane apron]. Bubblers must also be controlled by push levers, by push bars, or touch pads one on each side or one on front and both sides of the cabinet.[Provide filters for chlorine in supply piping to faucets.]

2.4.18 Energy Star Label for Freestanding Bottled Water Coolers/Dispensers

2.4.18.1 Bottled Water Dispenser

Energy star labeled, [cold][and][hot] bottled water dispenser, [18.9][11.4] liter [5][3] gallon capacity,[top load][bottom load],[floor standing][countertop] unit.[Provide with a cold water temperature of 8.3 degrees C 47 degrees F.][Provide with a hot water temperature of 85 degrees C 185 degrees F.]

2.4.18.2 Bottleless Water Dispenser

Energy Star Labeled, [cold][and][hot] bottleless water dispenser with filters, 1.89 L/minute 0.5 gpm flow rate,[floor standing][countertop] unit.[Provide with a cold water temperature of 8.3 degrees C 47 degrees F.][Provide with a hot water temperature of 85 degrees C 185 degrees F.]

2.4.19 Shower Faucets

Provide ball joint self-cleaning shower heads. Provide WaterSense labeled showerhead with a maximum flow rate of 6.6 L/min 1.75 gpm. Provide data identifying WaterSense label for showerhead. Fixtures that require the WaterSense label but are located in countries where the label is unavailable, see table below or see https://uwla.eu/ for WaterSense label substitutes.

WaterSense Equivalencies	
Australia	WELs
Canada	WaterSense

Non-Mandatory Labels*	
European Union	European Water Label

Non-Mandatory Labels*	
Taiwan	Water Saving Label
China, Hong Kong	WELS

*Water efficiency labels recognized as market transformational, and are recommended, but not required for LEED projects.

2.4.20 Plastic Bathtub/Shower Units

****
NOTE: This paragraph is also tailored for NAVY and AIR FORCE.
****

CSA B45.5-17/IAPMO Z124 four piece [white][_____] solid acrylic pressure molded fiberglass reinforced plastic bathtub/shower units. Units must be scratch resistant, waterproof, and reinforced. Provide showerheads meeting the requirements of the paragraph BATHTUB AND SHOWER FAUCETS AND DRAIN FITTINGS.[Provide flow restrictor in handshower to flow 6.6 L/min 1.75 gpm.][Provide filters for chlorine in supply piping to faucets and showerheads.] Provide recessed type units approximately 1524 mm 60 inches wide, 762 mm 30 inches front to rear, 1829 mm 72 inches high with 381 mm 15 inches high rim for through-the-floor drain installation with unit bottom or feet firmly supported by a smooth level floor. Provide left or right drain outlet units as required. Units must have built-in soap dish and minimum of 305 mm 12 inch long stainless steel horizontal grab bar located on back wall for standing use. Units must meet performance requirements of CSA B45.5-17/IAPMO Z124 and must be labeled by NAHB Research Foundation, Inc. for compliance. Install unit in accordance with the manufacturer's written instructions. Finish installation by covering unit attachment flanges with wall board in accordance with unit manufacturer's recommendation. Provide smooth 100 percent silicone rubber [white][_____] bathtub caulk between the unit and the adjacent walls and floor surfaces.

2.4.21 Plastic Bathtubs

****
NOTE: This paragraph is also tailored for NAVY and AIR FORCE.
****

CSA B45.5-17/IAPMO Z124 one piece [white][_____] solid acrylic pressure molded fiberglass reinforced plastic bathtubs. Bathtubs must be scratch resistant, waterproof, and reinforced. Provide recessed type bathtubs approximately 1524 mm 60 inches wide, 762 mm 30 inches front to rear, 381 mm 15 inches high rim for through-the-floor drain installation with bathtub bottom or feet firmly supported by a smooth level floor. Provide left or right drain outlet bathtub as required.[Provide filters for chlorine in supply piping to faucets.] Bathtubs must meet performance requirements of CSA B45.5-17/IAPMO Z124 and must be labeled by NAHB Research Foundation, Inc. for compliance. Install bathtub in accordance with the manufacturer's written instructions. Finish installation by covering bathtub attachment flanges with dry-wall in accordance with bathtub manufacturer's recommendation. Provide smooth 100 percent silicone rubber [white][_____] bathtub caulk between the bathtub and the

adjacent walls and floor surfaces.

2.4.22 Plastic Shower Stalls

****
NOTE: This paragraph is also tailored for NAVY and AIR FORCE.
****

CSA B45.5-17/IAPMO Z124 four piece [white][_____] solid acrylic pressure molded fiberglass reinforced plastic shower stalls. Shower stalls must be scratch resistant, waterproof, and reinforced. Provide showerheads meeting the requirements of the paragraph BATHTUB AND SHOWER FAUCETS AND DRAIN FITTINGS.[Provide filters for chlorine in supply piping to showerheads.] Provide PVC shower floor drains and stainless steel strainers. Shower stalls must meet performance requirements of CSA B45.5-17/IAPMO Z124 and must be labeled by NAHB Research Foundation, Inc. for compliance. Install shower stall in accordance with the manufacturer's written instructions. Finish installation by covering shower stall attachment flanges with dry-wall in accordance with shower stall manufacturer's recommendation. Provide smooth 100 percent silicone rubber [white][_____] bathtub caulk between the top, sides, and bottom of shower stalls and bathroom walls and floors.

2.4.22.1 Standard Shower Stall

Provide recessed type shower stall approximately 914.4 mm 36 inches wide, 914.4 mm 36 inches front to rear, 1930.4 mm 76 inches high, with a 127 mm 5 inch high curb with shower stall bottom or feet firmly supported by a smooth level floor.

2.4.22.2 Transfer Type Shower Stall (ADA)

Provide recessed type, barrier free threshold type shower stall approximately 914.4 mm 36 inches wide, 914.4 mm 36 inches front to rear, 1930.4 mm 76 inches high. Clearance of 914.4 mm 36 inches wide minimum by 1219 mm 48 inches long minimum measured from the control wall must be provided, with shower stall bottom or feet firmly supported by a smooth level floor. Provide shower seat and grab bars. Provide flow restrictor in handshower[with slidebar] to flow 6.63 L/min 1.75 gpm.

2.4.22.3 Standard Roll-in Type Shower Stall (ADA)

Provide recessed type, barrier free threshold shower stall, minimum 1524 mm 60 inches wide, 762 mm 30 inches front to rear with shower stall bottom or feet firmly supported by a smooth level floor. Provide shower seat and grab bars. Provide flow restrictor in handshower[with slidebar] to flow 6.63 L/min 1.75 gpm.

2.4.23 Plastic Bathtub Liners

****
NOTE: This paragraph is also tailored for NAVY and AIR FORCE.
****

IAPMO Z124.8 one piece [white][_____] plastic bathtub liners. Existing bathtubs must be identified and measured to insure proper identification in order that each new bathtub liner must be custom molded to fit the

exact contours of the existing bathtubs. Provide left or right drain outlet bathtub liners as required. Bathtub liners must be inserted over and into the existing bathtubs without disturbing the existing ceramic tile wainscot walls and existing floor material. Prepare the existing cast-iron bathtubs, ceramic tile wainscots, and floor to receive the new bathtub liners in accordance with the bathtub liner manufacturer's written instructions. Installation personnel must be trained by the bathtub liner manufacturer. Seal the bathtub liner to existing bathtub with waterproof adhesive as required to keep moisture out from behind the bathtub liner. Provide smooth [white][_____] waterproof bathtub sealant between bathtub drains, bathtub, and bathtub liners. Provide replacement chromium-plated overflow cover plates and push-pull bathtub drain stopper assembly. Provide smooth 100 percent silicone rubber [white][_____] bathtub caulk between the bathtub liner and the adjacent walls and floor surfaces in accordance with the bathtub liners manufacturer's written instructions.

2.4.24 Plastic Bathtub Wall Surrounds

****
NOTE: This paragraph is also tailored for NAVY and AIR FORCE.
****

CSA B45.5-17/IAPMO Z124 three piece [white][_____] sectional pressure molded fiberglass plastic bathtub wall surrounds suitable for installation with existing bathtubs which are approximately 1524 mm 60 inches wide by 762 mm 30 inches front to rear. Wall surrounds must have built-in soap dish and minimum of 305 mm 12 inch long stainless steel horizontal grab bar located on back wall for standing use. Bathtub wall surrounds must meet performance requirements of CSA B45.5-17/IAPMO Z124 and must be labeled by NAHB Research Foundation, Inc. for compliance. Install bathtub wall surrounds in accordance with the manufacturers written instructions. Finish installation by covering bathtub wall surround attachment flanges with dry-wall in accordance with bathtub wall surround manufacturer's recommendations. Provide smooth 100 percent silicone rubber [white][_____] bathtub caulk between the bathtubs and the adjacent walls and floor surfaces.

2.4.25 Precast Terrazzo Shower Floors

Terrazzo must be 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.

2.4.26 Precast Terrazzo Mop Sinks

Terrazzo must be made of marble chips cast in white portland cement to produce 25 mPa 3000 psi minimum compressive strength 7 days after casting. Terrazzo can include[corner type][stainless steel curb cap][wall guard] additions with minimum dimensions of [610 mm 24 inches][_____] wide by [610 mm 24 inches][_____] length by [305 mm 12 inches][_____] height. Provide floor or wall outlet copper alloy body drain cast integral with terrazzo, with polished stainless steel strainers.

2.4.27 Bathtubs, Cast Iron

****
NOTE: This paragraph contains tailoring for AIR

FORCE.

****

ASME A112.19.1/CSA B45.2, [white][_____] enameled cast iron, recessed type, minimum dimensions of 1524 mm 60 inches wide by 762 mm 30 inches front to rear by 406 mm 16 inches high with drain outlet for above-the-floor drain installation. Provide left or right drain outlet bathtub as indicated.[Provide filters for chlorine in supply piping to faucets.]

2.4.28 Bathtubs, Porcelain

****

NOTE: This paragraph contains tailoring for AIR FORCE.

This tub type is meant to be used in conjunction with the above type (Bathtubs, Cast Iron). Do not use alone, but as an option in concurrence with cast iron.

****

ASME A112.19.1/CSA B45.2, [white][_____] porcelain bonded to enameling grade metal, bonded to a structural composite, recessed type, minimum dimensions of 1524 mm 60 inches wide by 762 mm 30 inches front to rear by 406 mm 16 inches high with drain outlet for above-the-floor drain installation. Provide left or right drain outlet bathtub as indicated.[Provide filters for chlorine in supply piping to faucets.]

2.4.29 Emergency Eyewash and Shower

ANSI/ISEA Z358.1, floor supported free standing[freeze protected] unit[with privacy curtain]. Provide deluge shower head, stay-open ball valve operated by pull rod and ring or triangular handle. Provide eyewash dust[caps][cover] and stay-open ball valve operated by foot treadle or push handle. Unit must deliver a minimum of 75.7 L/min 20 gpm of water at 207 kPa 30 psig flow pressure for 15 minutes. Eye wash unit must have a minimum of 1.51 L/min 0.4 gpm of water at 207 kPa 30 psig flow pressure for 15 minutes. Position eye wash nozzles 838 mm 33 inches to 1143 mm 45 inches above finished floor. Provide copper alloy control valves. Provide an air-gap with the lowest potable eye 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 15.6 degrees C 60 degrees F to 35 degrees C 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].]

2.4.30 Emergency Eye and Face Wash

ANSI/ISEA Z358.1,[floor][wall-mounted][freeze protected], self-cleaning, nonclogging eye and face wash with quick opening, full-flow valves,[dust covers,][stainless steel][plastic] eye and face wash receptor. Unit must deliver a minimum of 0.19 L/s 3 gpm of aerated water at 207 kPa (gage) 30 psig flow pressure, with eye and face wash nozzles 838 to 1143 mm 33 to 45 inches above finished floor. 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 15.5 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].]

2.4.31 Emergency Eyewash

ANSI/ISEA Z358.1,[floor][wall-mounted],[freeze protected,] nonclogging eye-wash with quick opening, full-flow valves,[dust covers,][stainless steel][plastic] eye-wash receptor. Unit must deliver a minimum of 1.51 L/min 0.4 gpm of water at 207kPa 30 psig flow pressure, with eye wash nozzles 838 mm to 1143 mm 33 inches to 45 inches above finished floor. Provide copper alloy control valves. Provide an air-gap with the lowest potable eye 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 15.6 degrees C to 35 degrees C 60 degrees F 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].]

2.4.32 Portable, Self-Contained Eyewash Unit

ANSI/ISEA Z358.1. For locations without access to a continuous potable water source, provide unit with pressure tank [57][140] L [15][37] gallons. [ASME][Non-ASME], stainless steel, cylindrical, with pressure gage, and suitable for on-floor installation, two spray heads mounted on tank. Unit must deliver minimum 1.51 L/min 0.4 gpm for at least 15 minutes. Provide with flushing fluid.

2.5 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 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.

****

Backflow prevention devices must be approved by the State or local regulatory agencies. If there is no State or local regulatory agency requirements, the backflow prevention devices must be listed by the Foundation for Cross-Connection Control & Hydraulic Research, or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention devices and assemblies. Reduced pressure principle assemblies, double check valve assemblies, atmospheric (nonpressure) type vacuum breakers, and pressure

type vacuum breakers must be meet the above requirements.

Backflow preventers with intermediate atmospheric vent must conform to ASSE 1012. Reduced pressure principle backflow preventers must conform to ASSE 1013. Hose connection vacuum breakers must conform to ASSE 1011. Pipe applied atmospheric type vacuum breakers must conform to ASSE 1001. Pressure vacuum breaker assembly must conform to ASSE 1020. Air gaps in plumbing systems must conform to ASME A112.1.2.

2.6 DRAINS

****

NOTE: Provide potable, reclaimed or gray water supply trap primer, waste water supplied trap primer, barrier-type trap seal protection or electronic trap primer device where there will be a problem with the trap drying out.

****

2.6.1 Floor and Shower Drains

Floor and shower drains must consist of a galvanized body, integral seepage pan, and adjustable perforated or slotted chromium-plated bronze, nickel-bronze, or nickel-brass strainer, consisting of grate and threaded collar. Floor drains must be cast iron except where metallic waterproofing membrane is installed. Drains must be of double drainage pattern for embedding in the floor construction. The seepage pan must have weep holes or channels for drainage to the drainpipe. The seepage pan and weep holes must not be filled or plugged and have pervious materials (such as pea gravel) or a weep hole protection device to allow drainage. The strainer must be adjustable to floor thickness. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or waterproofing membrane must be provided when required. Drains must be provided with threaded connection. Between the drain 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 must conform to ASME A112.6.3.[Provide drain with trap primer connection, trap primer, and connection piping. Primer must meet ASSE 1018.]

2.6.1.1 Metallic Shower Pan Drains

Where metallic shower pan membrane is installed, polyethylene drain with corrosion-resistant screws securing the clamping device must be provided. Polyethylene drains must have fittings to adapt drain to waste piping. Polyethylene for floor drains must conform to ASTM D1248. Drains must have separate cast-iron "P" trap, circular body, seepage pan, and strainer, unless otherwise indicated.

2.6.1.2 Drains and Backwater Valves

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

2.6.2 Bathtub and Shower Faucets and Drain Fittings

****

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 faucets

****

Provide single control pressure equalizing bathtub and shower faucets with body mounted from behind the wall with threaded connections. Provide ball joint self-cleaning shower heads. Provide WaterSense labeled showerhead with a maximum flow rate of 6.6 L/min 1.75 gpm. Provide showerheads meeting the requirements in the paragraph SHOWER FAUCETS. Provide tubing mounted from behind the wall between bathtub faucets and shower heads and bathtub diverter spouts. Provide separate globe valves or angle valves with union connections in each supply to faucet. Provide trip-lever pop-up drain fittings for above-the-floor drain installations. The top of drain pop-ups, drain outlets, tub overflow outlet, and; control handle for pop-up drain must be chromium-plated or polished stainless steel. Linkage between drain pop-up and pop-up control handle at bathtub overflow outlet must be copper alloy or stainless steel. Provide 40 mm 1.5 inch copper alloy adjustable tubing with slip nuts and gaskets between bathtub overflow and drain outlet; chromium-plated finish is not required.[Provide bathtub and shower valve with ball type control handle.]

2.6.3 Area Drains

Area drains must be plain pattern with polished stainless steel perforated or slotted grate and bottom outlet. The drain must be circular or square with a 300 mm 12 inch nominal overall width or diameter and 250 mm 10 inch nominal overall depth. Drains must be cast iron with manufacturer's standard coating. Grate must be easily lifted out for cleaning. Outlet must be suitable for inside caulked connection to drain pipe. Drains must conform to ASME A112.6.3.

2.6.4 Floor Sinks

Floor sinks must be [circular][square], with 300 mm 12 inch nominal overall width or diameter and 250 mm 10 inch nominal overall depth. Floor sink must have an acid-resistant enamel interior finish with cast-iron body, [aluminum][ABS] sediment bucket, and perforated grate of cast iron in industrial areas and stainless steel in finished areas. The outlet pipe size must be as indicated or of the same size as the connecting pipe.

2.6.5 Boiler Room Drains

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NOTE: Boiler room drain will be used where coal is the heating fuel.

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Boiler room drains must have combined drain and trap, hinged grate, removable bucket, and threaded brass cleanout with brass backwater valve. The removable galvanized cast-iron sediment bucket must have rounded corners to eliminate fouling and must be equipped with hand grips. Drain must have a minimum water seal of 100 mm 4 inches. The grate area must be not less than 0.065 square meters 100 square inches.

2.6.6 Pit Drains

Pit drains must consist of a body, integral seepage pan, and nontilting perforated or slotted grate. Drains must be of double drainage pattern

suitable for embedding in the floor construction. The seepage pan must have weep holes or channels for drainage to the drain pipe. Membrane or flashing clamping device must be provided when required. Drains must be cast iron with manufacturer's standard coating. Drains must be circular and provided with bottom outlet suitable for inside caulked connection, unless otherwise indicated. Drains must be provided with separate cast-iron "P" traps, unless otherwise indicated.

2.6.7 Sight Drains

Sight drains must consist of body, integral seepage pan, and adjustable strainer with perforated or slotted grate and funnel extension. The strainer must have a threaded collar to permit adjustment to floor thickness. Drains must be of double drainage pattern suitable for embedding in the floor construction. A clamping device for attaching flashing or waterproofing membrane to the seepage pan without damaging the flashing or membrane must be provided for other than concrete construction. Drains must have a galvanized heavy cast-iron body and seepage pan and chromium-plated bronze, nickel-bronze, or nickel-brass strainer and funnel combination. Drains must be provided with threaded connection and with a separate cast-iron "P" trap, unless otherwise indicated. Drains must be circular, unless otherwise indicated. The funnel must be securely mounted over an opening in the center of the strainer. Minimum dimensions must be as follows:

Area of strainer and collar: 0.023 square meters 36 square inches

Height of funnel: 95 mm 3-3/4 inches

Diameter of lower portion: 50 mm 2 inches of funnel

Diameter of upper portion: 100 mm 4 inches of funnel

2.6.8 Roof Drains and Expansion Joints

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

2.6.9 Swimming Pool [and Spa]Suction Fittings

Pool water suction fittings in swimming pools[and spas] must comply with ANSI/APSP-16. The compliance of the fitting must include of the

associated drain cover, sump, and hardware. The fitting must be permanently marked to indicate compliance with the ASME standard, or permanently marked with the symbol "VGB 2008".

2.6.10 Trap Seal Protection

2.6.10.1 Potable Water-Supplied Trap Seal Valve

Trap must be supplied with a source of[potable water][non-potable, reclaimed or gray water]. The trap seal primer valve must conform to ASSE 1018. The discharge from the valve must connect to the trap seal on the inlet side of the trap.

2.6.10.2 Reclaimed Or Gray Water-Supplied Trap Seal Valve

Trap must be supplied with a source of reclaimed or gray water in accordance with manufacturer of valve. The trap seal primer valve must conform to ASSE 1018. The discharge from the valve must connect to the trap seal on the inlet side of the trap.

2.6.10.3 Waste Water-Supplied Trap Seal Device

Trap will be supplied with a source of waste water conforming to ASSE 1044. The discharge from the device must connect to the trap above the trap seal on the inlet side of the trap.

2.6.10.4 Barrier-Type Trap Seal Protection Device

Trap must be protected with a barrier-type trap seal protection device conforming to ASSE 1072 and must be installed in accordance with the manufacturer's instructions.

2.6.10.5 Electronic Trap Seal Primer

Electronic[recessed][surface mount] trap primer consisting of a solenoid valve, vacuum breaker and timer will deliver a timed discharge of water to trap. Provide electronic trap seal primer with [_____] ports[and hinged access door]. ASSE and UL 1951 listed.

2.7 SHOWER PAN

****

NOTE: 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.

****

Shower pan may be copper, or nonmetallic material.

2.7.1 Sheet Copper

Sheet copper must be 4.9 kg per square meter 16 ounce weight.

2.7.2 Plasticized Polyvinyl Chloride Shower Pan Material

Material must be sheet form. The material must be 1.016 mm 0.040 inch minimum thickness of plasticized polyvinyl chloride or chlorinated

polyethylene and must be in accordance with ASTM D4551.

2.7.3 Nonplasticized Polyvinyl Chloride (PVC) Shower Pan Material

Material must consist of a plastic waterproofing membrane in sheet form. The material must be 1.016 mm 0.040 inch minimum thickness of nonplasticized PVC and must have the following minimum properties:

a. or ASTM D638:

Ultimate Tensile Strength:	1.79 MPa 2600 psi
Ultimate Elongation:	398 percent
100 Percent Modulus:	3.07 MPa 445 psi

b. ASTM D1004:

Tear Strength:	53 kilonewtons per meter 300 pounds per inch

c. ASTM E96/E96M:

Permeance:	0.46 ng per Pa per second per sq meter 0.008 perms

d. Other Properties:

Specific Gravity:	1.29
PVC Solvent:	Weldable
Cold Crack:	minus 47 degrees C 53 degrees F
Dimensional stability	100 degrees C 212 degrees F minus 2.5 percent
Hardness, Shore A:	89

2.8 TRAPS

Unless otherwise specified, traps must be [plastic per ASTM F409][or][copper-alloy adjustable tube type with slip joint inlet and swivel]. Traps must be without a cleanout.[Provide traps with removable access panels for easy clean-out at sinks and lavatories.]Tubes must 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 must have rubber washer and copper alloy nuts for slip joints above the discharge level. Swivel joints must be below the discharge level and must be of metal-to-metal or metal-to-plastic type as required for the application. Nuts must have flats for wrench grip. Outlets must have internal pipe thread, except that when required for the application, the outlets must have sockets for solder-joint connections. The depth of the water seal must be not less than 50 mm 2 inches. The interior diameter must be not more than 3.2 mm 1/8 inch over or under the nominal size, and interior surfaces must 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 must be provided for lavatories. The assembly must be a standard manufactured unit and may have a rubber-gasketed swivel joint.

2.9 INTERCEPTORS

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

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2.9.1 Grease Interceptor

2.9.1.1 Gravity Grease Interceptor

Gravity grease interceptor[s] of the size indicated must be of[reinforced concrete][precast concrete construction][or steel][polyethylene] with removable[one][two][three]-section,[solid manhole cover][9.5 mm 3/8 inch checker-plate cover], and must be installed outside the building.[Provide sampling manhole.][Steel grease interceptor must be installed in a concrete pit and must be epoxy-coated to resist corrosion as recommended by the manufacturer.] Interceptors must be tested and rated in accordance with ANSI/IAPMO Z1001. Concrete must have 21 MPa 3,000 psi minimum compressive strength at 28 days.

2.9.1.2 Hydromechanical Grease Interceptor

Hydromechanical grease interceptor[s] of the size indicated must be of [polyethylene][steel] with removable[solid][checker-plate] cover, and can be installed[inside][outside] the building.[Provide sampling port.] Provide vented flow control device at inlet of hydromechanical grease interceptor in order to match flow downstream of control device with the interceptor's certified flow rate.

2.9.2 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.

2.9.3 Sand Interceptors

Sand interceptor of the size indicated must be of reinforced concrete,[or precast concrete construction][or equivalent capacity commercially available steel sand interceptor] with manufacturer's standard checker-plate cover, and must be installed[outside the building][top flush with the floor][floor mounted]. Steel sand interceptor must be installed in accordance with manufacturer's recommendations and must be coated to resist corrosion as recommended by the manufacturer.[Concrete must have 21 MPa 3,000 psi minimum compressive strength at 28 days.]

2.9.4 Lint Interceptors

Provide Lint Interceptor for laundry areas not in individual dwelling units. Interceptor to have removable lid and removable [screen][wire basket] to prevent passage of 12 mm 1/2 inch minimum size solids into the sanitary drainage system.

2.10 WATER HEATERS

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NOTE: This SUBPART is tailored for WATER HEATERS.

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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 and typical data of each water heater on an equipment schedule on the drawings in accordance with UFC 3-420-01 "Plumbing Systems".

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. Hot water systems utilizing recirculation systems should be tied into building off-hour controls. 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 values for efficiencies in Table III of PART 3 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: https://www.energy.gov/femp/incorporate-minimum-efficiency-requirements-heating-and-cooling-products-federal-acquisition

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.

****

Water heater types and capacities must be as indicated. Each water heater must have replaceable anodes. Each primary water heater must 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 must have controls with an adjustable range that includes 49 to 82 degrees C 120 to 180 degrees F. Hot water systems utilizing recirculation systems must be tied into building off-hour controls. The thermal efficiencies and standby heat losses must conform to TABLE III in PART 3 of this Section 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 must be installed on the cold water supply to each water heater. Expansion tanks must be specifically designed for use on potable water systems and must be rated for 93 degrees C 200 degrees F water temperature and 1034 kPa 150 psi

working pressure. The expansion tank size and acceptance volume must be [_____] [as indicated].

2.10.1 Automatic Storage Type

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NOTE: Gas-fired water heaters are more efficient in source energy use than electric resistance water heaters. Avoid use of electric type when possible. 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.

****

Heaters must be complete with [control system,] [control system, temperature gauge, and pressure gauge,] and must have ASME rated combination pressure and temperature relief valve.

2.10.1.1 Oil-Fired Type

Oil-fired type water heaters must conform to UL 732.

2.10.1.2 Gas-Fired Type

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NOTE: Include bracketed statements below when project includes gas storage water heater with a nominal input of 75,000 British thermal units (Btu) per hour or less and having a rated storage capacity of not less than 20 gallons nor more than 100 gallons.

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Gas-fired water heaters must conform 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.[Provide Energy Star labeled gas storage water heater. Provide data identifying Energy Star label for gas storage water heater.]

2.10.1.3 Electric Type

Electric type water heaters must conform to UL 174 with dual heating elements. Each element must be 4.5 KW. The elements must be wired so that only one element can operate at a time.

2.10.1.4 Indirect Heater Type

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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). The option for phenolic resin coating for heaters with service water in the shell and steam or hot water in the coil should be used only at locations where scaling on coil surfaces due to water hardness is severe or where corrosion-induced leaks are a severe problem.

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NOTE: 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 does not pass through occupied portions of the facilities.

****

Steam and high temperature hot water (HTHW) heaters with storage system must 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 must be as specified in paragraph HOT-WATER STORAGE TANKS. The heat exchanger must be [double wall] [single 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 must have a working pressure of 2758 kPa 400 psig with water at a temperature of 204 degrees C 400 degrees F. The heating surface must be based on 0.093 square meter 1 square foot of heating surface to heat 76 L 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 must be used. Tubing must conform to ASTM B111/B111M, Copper Alloy No. 706 (90-10 copper-nickel). Heating elements must withstand an internal hydrostatic pressure of 4137 kPa 600 psig for not less than 15 seconds without leaking or any evidence of damage.

b. Steam Energy Source: The heater element must have a working pressure of 1034 kPa per square meter 150 pounds per square inchgauge (psig) with steam at a temperature of 185 degrees C 365 degrees F. The heating surface must be based on 0.093 square meter 1 square foot of heating surface to heat 76 L 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 must be used. Tubing must be light-drawn copper tubing conforming to ASTM B75/B75M. Heating elements must withstand an internal hydrostatic pressure of 1551 kPa 225 psig for not less than 15 seconds without leaking or any evidence of damage.

2.10.2 Instantaneous Water Heater

Heater must be crossflow design with service water in the coil and [steam] [hot water] in the shell. An integral internal controller must 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 must be as specified by the manufacturer for the heater. Unit must be manufactured in accordance with ASME BPVC SEC VIII D1, and must 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 must be carbon steel with copper lining. Heads must be [cast iron] [bronze] [carbon steel plate with copper lining]. Coils must be [copper] [copper-nickel]. Shell must have metal sheathed fiberglass insulation, combination pressure and temperature relief valve, and thermometer. Insulation must be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. For gas service, provide Energy Star labeled gas instantaneous water heater. Provide data identifying Energy Star label for gas instantaneous water heater.

2.10.3 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. Temperature rise at Flow Rate: [[_____] degrees C at [_____] L/min [_____] degrees F at [_____] gpm][as indicated on drawings].

2.10.4 Phenolic Resin Coatings for Heater Tubes

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NOTE: The option for phenolic resin coating for heaters with service water in the shell and steam or hot water in the tubes should be used only at locations where scaling on waterside tube surfaces due to water hardness is severe or where corrosion-induced leaks are a severe problem.

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NOTE: If interior erosion of the tubes at or near the tube sheet is expected to be a severe problem, change the wording of this paragraph and its subparagraphs to require the coating to be applied to the first 125 to 200 mm 5 to 8 inches inside the tubes.

****

The phenolic resin coating system must be applied at either the coil or coating manufacturer's factory in accordance with manufacturer's standard proven production process. The coating system must be a product specifically intended for use on the material the water heating tubes/coils are made of and must be acceptable for use in potable water systems. The coating system must be capable of withstanding temperatures up to 204 degrees C 400 degrees F dry bulb; and meet the requirements of 21 CFR 175.

[The entire exterior surface][and][The first 125 mm to 200 mm 5 to 8 inches inside the tubes] of each coil must be coated with phenolic resin coating system.

2.10.4.1 Standard Product

Provide a phenolic resin coating system that is a standard product of a manufacturer regularly engaged in the manufacturing of products that are of a similar material, design, and workmanship.

Standard products are defined as components and equipment that have been in satisfactory commercial or industrial use in similar applications of similar size for at least 2 years before bid opening. Prior to this 2 year period, these standard products were sold on the commercial market using advertisements in manufacturers' catalogs or brochures. These manufacturers' catalogs, or brochures must have been copyrighted documents or be identified with a manufacturer's document number.

2.10.4.2 Expansion Tank

Provide a[n][ASME] potable water expansion tank of steel construction with a NSF/ANSI/CAN 61 Butyl diaphragm separating the air chamber from the water containing container. Tank must have a stainless steel inlet connector. Diaphragm must be FDA approved. Maximum operating temperature 93 degrees C 200 degrees F, Maximum Working Pressure: 1034 kPa 150 PSIG (10.3 bar).

2.11 HOT-WATER STORAGE TANKS

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NOTE: This SUBPART is tailored for WATER HEATERS.
****

Hot-water storage tanks must be constructed by one manufacturer, ASME stamped for the working pressure, and must have the National Board (ASME) registration. The specification AWWA D100 provides standards for water storage tanks, not domestic hot water storage tanks under domestic water pressure. The statement prior describes the tanks being ASME, it must be ASME BPVC (Boiler and Pressure Vessel Code), stamped for working pressure. The two statements combined describe a hot water storage tank under domestic water pressure. The tank must be cement-lined or glass-lined steel type in accordance with AWWA D100. The heat loss must conform to TABLE III in PART 3 of this Section as determined by the requirements of ASHRAE 90.1 - SI ASHRAE 90.1 - IP. Each tank must 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 must have a separable socket suitable for a 20 mm 3/4 inch tapped opening. Tanks must be equipped with a pressure gauge 155 mm 6 inch minimum diameter face. Insulation must be as specified in Section 23 07 00 THERMAL INSULATION FOR MECHANICAL SYSTEMS. Storage tank capacity must be as shown. Install hot water storage tanks with access hatches in order to facilitate annual cleaning and inspections.

2.12 PUMPS

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NOTE: This SUBPART is tailored for PUMPS.
****

2.12.1 Sump Pumps

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

****

Sump pumps must be of capacities indicated. The pumps must be 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 must 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 must be totally enclosed, fan-cooled of sizes as indicated and must be equipped with an across-the-line magnetic controller in a NEMA 250, Type [1][4] enclosure. Integral size motors must be the premium efficiency type in accordance with NEMA MG 1. Each pump must be fitted with a high-grade thrust bearing mounted above the floor. Each shaft must have an alignment bearing at each end, and the suction inlet must be between 75 and 150 mm 3 and 6 inches above the sump bottom. The suction side of each pump must have a strainer of ample capacity. A float switch assembly, with the switch completely enclosed in a NEMA 250, Type [1][4] enclosure, must start and stop each motor at predetermined water levels. Duplex pumps must 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 must be provided with a union or flange, a nonclog swing check valve, and a stop valve in an accessible location near the pump.

2.12.2 Circulating Pumps

Domestic hot water circulating pumps must be electrically driven, single-stage, centrifugal, with mechanical seals, suitable for the intended service. Pump and motor must 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 must be one-piece, heat-treated, corrosion-resisting steel with impeller and smooth-surfaced housing of bronze.

2.12.2.1 Circulating Pump Enclosure

Motor must be totally enclosed, fan-cooled and must have sufficient wattage horsepower for the service required. Each pump motor must be equipped with an across-the-line magnetic controller in a NEMA 250, Type 1 enclosure with "START-STOP" switch in cover.

2.12.2.2 Circulating Pump Size and Efficiency

Integral size motors must be premium efficiency type in accordance with NEMA MG 1. Pump motors smaller than 746 W 1 hp Fractional horsepower pump motors must have integral thermal overload protection in accordance with Section 26 20 00 INTERIOR DISTRIBUTION SYSTEM. Guards must shield exposed moving parts.

2.12.3 Booster Pumps

2.12.3.1 Centrifugal Pumps

Horizontal split-case centrifugal-type booster pumps must be furnished. The capacities must be as indicated on drawings, and the speed must not exceed 1800 rpm. Pumps must have a casing of close-grained iron or steel with smooth water passages. A gasket must be provided between the upper and lower halves of the casing. Suction and discharge connections must be flanged. Impellers must be nonoverloading, bronze, balanced to eliminate

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

2.12.3.2 Controls

Each pump motor must be provided 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 must be automatically started and stopped by float or pressure switches, as indicated. The pumps must start and stop at the levels and pressures indicated. A multiposition sequence selector switch must be provided so that any two pumps may be operated simultaneously keeping a third pump as a standby.

2.12.4 Flexible Connectors

****

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. Flexible connectors should also be provided for fluid media temperatures in access of 82 degrees C 180 degrees F.

****

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

2.12.5 Sewage Pumps

Provide single type 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.

2.13 WATER PRESSURE BOOSTER SYSTEM

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NOTE: This SUBPART is tailored for PUMPS.

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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 L/s 25 gpm and total head is at least 59.78 kPa 20 feet.

****

2.13.1 Constant Speed Pumping System

Constant speed pumping system with pressure-regulating valves must employ one lead pump for low flows, and one or more lag pumps for higher flows. Pressure-regulating valves must be provided with nonslam check feature. The factory prepiped and prewired assembly must be mounted on a steel frame, complete with pumps, motors, and automatic controls. The system capacity and capacity of individual pumps must be as indicated. Current sensing relays must provide staging of the pumps. The pumps must be protected from thermal buildup, when running at no-flow, by a common thermal relief valve. Pressure gauges must be mounted on the suction and discharge headers. The control panel must bear the UL listing label for industrial control panels and must be in a NEMA 250, Type 1 enclosure. The control panel must 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 must be interlocked so that the failure of any controller must energize the succeeding controller.

2.13.2 Hydro-Pneumatic Water Pressure System

An ASME code constructed tank stamped for 862 kPa 125 psig water working pressure must be provided. The tank must have a flexible diaphragm made of material conforming to FDA requirements for use with potable water and must be factory precharged to meet required system pressure.

2.13.3 Variable Speed Pumping System

Variable speed pumping system must provide system pressure by varying speed and number of operating pumps. The factory prepiped and prewired assembly must be mounted on a steel frame complete with pumps, variable speed drives, motors, and controls. The variable speed drives must be the oil-filled type capable of power transmission throughout their complete speed range without vibration, noise, or shock loading. Each variable speed drive must be run-tested by the manufacturer for rated performance, and the manufacturer must furnish written performance certification. System must have suppressors to prevent noise transmission over electric feed lines. Required electrical control circuitry and system function sensors must be supplied by the variable speed drive manufacturer. The primary power controls and magnetic motor controllers must be installed in[the controls supplied by the drive manufacturer][the motor control center]. The sensors must 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 must be accomplished with[hydraulic sensing

lines][copper wiring][telemetry]. Controls must be in NEMA 250, Type 1 enclosures.

2.14 COMPRESSED AIR SYSTEM

****
NOTE: This SUBPART is tailored for COMPRESSED AIR SYSTEM. Reference UFC 3-420-02 Compressed Air for additional requirements.
****

2.14.1 Air Compressors

Air compressor unit must be a factory-packaged assembly, including [_____] phase, [_____] volt motor controls, switches, wiring, accessories, and motor controllers, in a NEMA 250, Type [1][4] enclosure. Tank-mounted air compressors must be manufactured to comply with UL listing requirements. Air compressors must have manufacturer's name and address, together with trade name, and catalog number on a nameplate securely attached to the equipment. Each compressor must[start and stop automatically at upper and lower pressure limits of the system][regulate pressure by constant speed compressor loading and unloading][have a manual-off-automatic switch that when in the manual position, the compressor loads and unloads to meet the demand and, in the automatic position, a time delay relay must allow the compressor to operate for an adjustable length of time unloaded, then stop the unit]. Guards must shield exposed moving parts. Each duplex compressor system must be provided with [automatic][manual] alternation system. Each compressor motor must be provided with an across-the-line-type magnetic controller, complete with low-voltage release. An intake air filter and silencer must be provided with each compressor. Aftercooler and moisture separator must be installed between compressors and air receiver to remove moisture and oil condensate before the air enters the receiver. Aftercoolers must be either air- or water-cooled, as indicated. The air must pass through a sufficient number of tubes to affect cooling. Tubes must be sized to give maximum heat transfer. Water to unit must be controlled by a solenoid or pneumatic valve, which opens when the compressors start and closes when the compressors shut down. Cooling capacity of the aftercooler must be sized for the total capacity of the compressors. Means must be provided for draining condensed moisture from the receiver by an automatic float type trap. Capacities of air compressors and receivers must be as indicated.

2.14.2 Lubricated Compressors

****
NOTE: Where a suitable compressing station is shown for delivering air to laundries and linen-repair rooms, in addition to the shops, a duplicate compressor will be required for compressing and delivering air. Lubricated type compressors are required for delivery of air to linen repair at 552 kPa 80 psig, laundry at 586 kPa 85 psig, and general laboratories and shops at 345 kPa 50 psig.
****

Compressors must be two-stage, V-belt drive, capable of operating continuously against their designed discharge pressure, and must operate at a speed not in excess of 1800 rpm. Compressors must have the capacity and discharge pressure indicated. Compressors must be assembled complete

on a common subbase. The compressor main bearings must be either roller or ball. The discharge passage of the high pressure air must be piped to the air receiver with a copper pipe or tubing. A pressure gauge calibrated to 1.03 MPa 150 psi and equipped with a gauge cock and pulsation dampener must be furnished for installation adjacent to pressure switches.

2.14.3 Air Receivers

Receivers must be designed for 1.38 MPa 200 psi working pressure. Receivers must be factory air tested to 1-1/2 times the working pressure. Receivers must be equipped with safety relief valves and accessories, including pressure gauges and automatic and manual drains. The outside of air receivers may be galvanized or supplied with commercial enamel finish. Receivers must be designed and constructed in accordance with ASME BPVC SEC VIII D1 and must have the design working pressures specified herein. A display of the ASME seal on the receiver or a certified test report from an approved independent testing laboratory indicating conformance to the ASME Code must be provided.

2.14.4 Intake Air Supply Filter

****

NOTE: Indicate location and capacities of the air filters on the drawings. Specially filtered air should be provided for all locations, except laundries and garages.

****

Dry type air filter must be provided having a collection efficiency of 99 percent of particles larger than 10 microns. Filter body and media must withstand a maximum 862 kPa 125 psi, capacity as indicated.

2.14.5 Pressure Regulators

The air system must be provided with the necessary regulator valves to maintain the desired pressure for the installed equipment. Regulators must be designed for a maximum inlet pressure of 862 kPa 125 psi and a maximum temperature of 93 degrees C 200 degrees F. Regulators must be single-seated, pilot-operated with valve plug, bronze body and trim or equal, and threaded connections. The regulator valve must include a pressure gauge and must be provided with an adjustment screw for adjusting the pressure differential from 0 kPa to 862 kPa 0 to 125 psi. Regulator must be sized as indicated.

2.15 DOMESTIC WATER SERVICE METER

****

NOTE: Size meters using AWWA (not IPC) fixture value method for determining maximum flow (AWWA M22 figures 4-2 and 4-3). Best practice to select the smallest possible meter where maximum flow, using AWWA M6 and M22, does not exceed 90 percent of the meter's maximum rated flow. For maximum flows exceeding those of a 50 mm 2 inch positive displacement meter (approximately 545 L/min 144 gpm), a compound meter should be used. Limit use of turbine meters to applications having consistent medium to high flows such as on the discharge of a

water pump station. Expect the water meter size to be at least on to tow pipe sizes smaller than the pipe. Provide lockable by-pass for all meters 40 mm 1-1/2 inch and greater.

NOTE: This paragraph contains tailoring for Navy, Army, and Air Force projects.

****

The requirements for metering and submetering are specified in Section 33 11 00 WATER UTILITY DISTRIBUTION PIPING.

[Cold water meters 50 mm 2 inches and smaller must be positive displacement type conforming to AWWA C700.[Cold water meters 64 mm 2-1/2 inches and larger must be turbine type conforming to AWWA C701.] Water meters must be[positive displacement,][ultrasonic magnetic inductive] type. Meter register may be round or straight reading type,[indicating [_____]][as provided by the local utility]. Meter must be provided with a pulse generator, remote readout register and all necessary wiring and accessories. Meters must be connected to the base wide energy and utility monitoring and control system (if this system exists) using the installation's advanced metering protocols.

]2.16 POOL WATER PUMP SAFETY VACUUM RELEASE SYSTEM (SVRS)

****

NOTE: This section is tailored for PUMPS.

****

Safety vacuum release system (SVRS) must meet the requirements specified in ASME A112.19.17, or ASTM F2387, as modified and supplemented by this specification. System must include:

Vacuum monitoring at least 60 times per second.
Power supply monitoring at least 50 times per second.
Capable of integration with existing timer box.
Low vacuum sensing and alarm.
Maintenance override.
Power back-up.
Display of error readout.
Turns off power to pump in milliseconds upon detecting sudden vacuum change.
Multiple audible alarm capabilities for multiple harmful situations.

2.17 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 third 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 INTERIOR DISTRIBUTION SYSTEM for individual motors that are not part of a packaged system.

****

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.

2.17.1 Electrical Requirements for Motors

Motors must be rated for continuous duty with the enclosure specified. Motor duty requirements must allow for maximum frequency start-stop operation and minimum encountered interval between start and stop. Motor torque must 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 must be fitted with grease supply fittings and grease relief to outside of the enclosure.

2.17.2 Electrical Requirements for Controllers and Contactors

Controllers and contactors must 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, must be provided. For packaged equipment, the manufacturer must provide controllers, including the required monitors and timed restart.

2.17.3 Electrical Requirements for Power Wiring

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

2.18 MISCELLANEOUS PIPING ITEMS

2.18.1 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

2.18.2 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Sleeves are not required where[supply] drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade, except where penetrating a membrane waterproof floor. For multiple pipe penetrations through load bearing masonry or concrete walls, minimum spacing must be [_____] mm [_____] inches center of pipe to center of pipe.

2.18.2.1 Sleeves in Masonry and Concrete

Provide steel pipe sleeves or schedule 40 PVC plastic pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2.18.2.2 Sleeves Not in Masonry and Concrete

Provide 26 gage galvanized steel sheet or PVC plastic pipe sleeves.

2.18.3 Pipe Hangers (Supports)

Provide MSS SP-58 Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joists with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 21, 28, 29, or 30 clamps. Attach to steel angles and vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.18.4 Nameplates

Provide 3.2 mm 0.125 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 0.25 inch high normal block lettering into the white core. Minimum size of nameplates must be 25 by 63 mm 1.0 by 2.5 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.

2.18.5 Water Conditioning

Refer to Section 22 31 00 WATER SOFTENERS, CATION-EXCHANGE (SODIUM CYCLE).

PART 3 EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

****
NOTE: This paragraph is tailored for PIPING.
****

Piping located in air plenums must conform to NFPA 90A requirements. Piping located in shafts that constitute air ducts or that enclose air ducts must 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 must be installed complete with necessary fixtures, fittings, traps, valves, and accessories. Submit diagrams, instructions, and other sheets proposed for posting for Plumbing System. Submit for Plumbing System manufacturer's recommendations for the installation of bell and spigot and hubless joints for cast iron soil pipe. Water and drainage piping must be extended 1.5 m 5 feet outside the building, unless otherwise indicated. A[gate valve][full port ball valve][ball valve] and drain must be installed on the water service line inside the building approximately 150 mm 6 inches above the floor from point of entry. Piping must be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes must be laid in separate trenches, except when otherwise shown. Exterior underground utilities must be at least 300 mm 12 inches below the [average local frost depth] [finish grade] or as indicated on the drawings. 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 must be marked with a stake or other acceptable means. Valves must be installed with control no lower than the valve body. Avoid the use of combination double wye and one-eighth bend fittings in the horizontal orientation below grade or below slab.

3.1.1 Water Pipe, Fittings, and Connections

3.1.1.1 Utilities

****
NOTE: This paragraph is tailored for PIPING.
****

The piping must be extended to fixtures, outlets, and equipment. The hot-water and cold-water piping system must 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, must 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 must be anchored to prevent movement.

3.1.1.2 Cutting and Repairing

****

NOTE: This paragraph is tailored for PIPING.
****

The work must be carefully laid out in advance, and unnecessary cutting of construction must be avoided. Damage to building, piping, wiring, or equipment as a result of cutting must be repaired by mechanics skilled in the trade involved.

3.1.1.3 Protection of Fixtures, Materials, and Equipment

****
NOTE: This paragraph is tailored for PIPING.
****

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

3.1.1.4 Mains, Branches, and Runouts

****
NOTE: This paragraph is tailored for PIPING and contains tailoring for ARMY.
****

Piping must be installed as indicated. Pipe must be accurately cut and worked into place without springing or forcing. Structural portions of the building must not be weakened. Aboveground piping must 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 must be kept a sufficient distance from other work and other services to permit not less than 12 mm 1/2 inch between finished covering on the different services. Bare and insulated water lines must 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 must not be buried in or under floors unless specifically indicated or approved. Buried domestic waste vent piping must not be less than 51 mm 2 inch diameter. Changes in pipe sizes must 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 must be made with fittings, except that bending of pipe 100 mm 4 inches and smaller will be permitted, provided a pipe bender is used and wide sweep bends are formed. The center-line radius of bends must be not less than six diameters of the pipe. Bent pipe showing kinks, wrinkles, flattening, or other malformations will not be acceptable.

3.1.1.5 Pipe Drains

****
NOTE: This paragraph is tailored for PIPING. Designer will indicate location of pipe drains on the drawings.
****

Pipe drains indicated must consist of 20 mm 3/4 inch hose bibb with renewable seat and[gate][full port ball][ball] valve ahead of hose bibb. At other low points, 20 mm 3/4 inch brass plugs or caps must be provided. Disconnection of the supply piping at the fixture is an acceptable drain.

3.1.1.6 Expansion and Contraction of Piping

****
NOTE: This paragraph is tailored for PIPING.
****

Allowance must be made throughout for expansion and contraction of water pipe. Each hot-water and hot-water circulation riser must have expansion loops or other provisions such as offsets and changes in direction where indicated and required. Risers must be securely anchored as required or where indicated to force expansion to loops. Branch connections from risers must 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 must be anchored to the wall or the supporting construction about midway on the run to force expansion, evenly divided, toward the ends. Sufficient flexibility must be provided on branch runouts from mains and risers to provide for expansion and contraction of piping. Flexibility must 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.

3.1.1.7 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 must be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking must be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa 2000 psi after 28 days. Blocking must be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed on drawings, the base and thrust bearing sides of the thrust block must be poured against undisturbed earth. The side of the thrust block not subject to thrust must be poured against forms. The area of bearing will be as indicated on drawings. Blocking must 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, must be used to anchor vertical down bends into gravity thrust blocks.

3.1.1.8 Commercial-Type Water Hammer Arresters

****
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 must 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.

****

Commercial-type water hammer arresters must be provided on hot- and cold-water supplies and must be located as generally indicated, with precise location and sizing to be in accordance with PDI WH 201. Water hammer arresters, where concealed, must be accessible by means of access doors or removable panels. Commercial-type water hammer arresters must conform to ASSE 1010. Vertical capped pipe columns will not be permitted.

3.1.2 Compressed Air Piping (Non-Oil Free)

****

NOTE: This paragraph is tailored for COMPRESSED AIR SYSTEM. Compressed air piping must be installed in accordance with UFC 3-420-02.

****

Compressed air piping must have supply lines and discharge terminals legibly and permanently marked at both ends with the name of the system and the direction of flow.

3.1.3 Joints

****

NOTE: This SUPBART is tailored for PIPING.

****

****

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 must 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 must be made up with fittings of compatible material and made for the specific purpose intended.

3.1.3.1 Threaded

Threaded joints must have American Standard taper pipe threads conforming to ASME B1.20.1. Only male pipe threads must be coated with graphite or

with an approved graphite compound, or with an inert filler and oil, or must have a polytetrafluoroethylene tape applied.

3.1.3.2 Mechanical Couplings

****
NOTE: Do not use this paragraph on NAVFAC projects.
****

[Mechanical couplings may be used in conjunction with grooved pipe for aboveground, ferrous or non-ferrous, domestic hot and cold water systems, in lieu of unions, brazed, soldered, welded, flanged, or threaded joints.

]3.1.3.2.1 Mechanical Coupling Permissibility

Mechanical couplings are permitted in accessible locations including behind access plates. Flexible grooved joints will not be permitted, except as vibration isolators adjacent to mechanical equipment. Rigid grooved joints must incorporate an angle bolt pad design which maintains metal-to-metal contact with equal amount of pad offset of housings upon installation to ensure positive rigid clamping of the pipe. Designs which can only clamp on the bottom of the groove or which utilize gripping teeth or jaws, or which use misaligned housing bolt holes, or which require a torque wrench or torque specifications will not be permitted.

3.1.3.2.2 Grooved Fittings and Couplings

Grooved fittings and couplings, and grooving tools must be provided from the same manufacturer. Segmentally welded elbows must not be used. Grooves must be prepared in accordance with the coupling manufacturer's latest published standards. Grooving must be performed by qualified grooving operators having demonstrated proper grooving procedures in accordance with the tool manufacturer's recommendations. The Contracting Officer must be notified 24 hours in advance of test to demonstrate operator's capability, and the test must be performed at the work site, if practical, or at a site agreed upon. The operator must demonstrate the ability to properly adjust the grooving tool, groove the pipe, and to verify the groove dimensions in accordance with the coupling manufacturer's specifications.

3.1.3.3 Unions and Flanges

Unions, flanges and mechanical couplings must not be concealed in walls, ceilings, or partitions. Unions must be used on pipe sizes 65 mm 2-1/2 inches and smaller; flanges must be used on pipe sizes 80 mm 3 inches and larger.

3.1.3.4 Grooved Mechanical Joints

****
NOTE: Do not use this paragraph on NAVFAC projects.
****

[Grooves must be prepared according to the coupling manufacturer's instructions. Grooved fittings, couplings, and grooving tools must be products of the same manufacturer. Pipe and groove dimensions must comply with the tolerances specified by the coupling manufacturer. The diameter of grooves made in the field must 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 must be measured and recorded for each change in grooving tool setup to verify compliance with coupling manufacturer's tolerances. Grooved joints must not be used in concealed locations.

]3.1.3.5 Cast Iron Soil, Waste and Vent Pipe

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

3.1.3.6 Copper Tube and Pipe

a. Brazed. Brazed joints must be made in conformance with AWS B2.2/B2.2M, ASME B16.50, and CDA A4015 with flux and are acceptable for all pipe sizes. Copper to copper joints must include the use of copper-phosphorus or copper-phosphorus-silver brazing metal without flux. Brazing of dissimilar metals (copper to bronze or brass) must include the use of flux with either a copper-phosphorus, copper-phosphorus-silver or a silver brazing filler metal.

b. Soldered. Soldered joints must be made with flux and are only acceptable for piping 50 mm 2 inches and smaller. Soldered joints must conform to ASME B31.5 and CDA A4015. Soldered joints must not be used in compressed air piping between the air compressor and the receiver.

c. Copper Tube Extracted Joint. Mechanically extracted joints must be made in accordance with ICC IPC.

****
NOTE: Coordinate with the Department of Public Works or Base Civil Engineer on the use of press fittings for copper pipe and tube.
****

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

]3.1.3.7 Plastic Pipe

Acrylonitrile-Butadiene-Styrene (ABS) pipe must have joints made with solvent cement. PVC and CPVC pipe must have joints made with solvent cement elastomeric, threading, (threading of Schedule 80 Pipe is allowed only where required for disconnection and inspection; threading of Schedule 40 Pipe is not allowed), or mated flanged.

3.1.3.8 Glass Pipe

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

3.1.3.9 Corrosive Waste Plastic Pipe

Joints for polyolefin pipe and fittings must be made by mechanical joint or electrical fusion coil method in accordance with ASTM D2657 and ASTM F1290. Joints for filament-wound reinforced thermosetting resin pipe must be made in accordance with manufacturer's instructions. Unions or flanges must be used where required for disconnection and inspection.

3.1.3.10 Polypropylene Pipe

Joints for polypropylene pipe and fittings must be made by heat fusion welding socket-type or butt-fusion type fittings and must comply with ASTM F2389.

3.1.4 Dissimilar Pipe Materials

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

3.1.5 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 CP 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 13 GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM, 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 must have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe must have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe must be in accordance with[Section 26 42 13 GALVANIC (SACRIFICIAL) ANODE CATHODIC PROTECTION (GACP) SYSTEM][and][Section 26 42 17 IMPRESSED CURRENT CATHODIC PROTECTION (ICCP) SYSTEM]. Coatings must be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe must be

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

3.1.6 Pipe Sleeves and Flashing

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

3.1.6.1 Sleeve Requirements

****

NOTE: Indicate the locations of all pipe sleeves on the design drawings. Indicate sleeves at locations where piping pass entirely through walls, ceilings, roofs, and floors. 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 23 05 48.19 [SEISMIC] BRACING FOR HVAC or Section 22 05 48.00 20 MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL.

****

Unless indicated otherwise, provide pipe sleeves meeting the following requirements:

a. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors.

b. 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 must 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 must 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 must cause the rubber sealing elements to expand and provide a watertight seal between the pipe and the sleeve. Each seal assembly must be sized as recommended by the manufacturer to fit the pipe and sleeve involved.

c. Sleeves must not be installed in structural members, except where indicated or approved. Rectangular and square openings must be as detailed. Each sleeve must extend through its respective floor, or roof, and must 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 must extend a minimum of 100 mm 4 inches above the finished floor.

d. Unless otherwise indicated, sleeves must be of a size to provide a minimum of [6][25] mm [1/4][1] 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 must 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.

e. Except as otherwise specified, the annular space between pipe and sleeve, or between jacket over insulation and sleeve, must be sealed as indicated 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 must not be sealed for interior walls which are not designated as fire rated.

f. Sleeves through below-grade walls in contact with earth must be recessed 12 mm 1/2 inch from wall surfaces on both sides. Annular space between pipe and sleeve must 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 must be compatible with dampproofing/waterproofing materials that are to be applied over the joint sealant. Pipe sleeves in fire-rated walls must conform to the requirements in Section 07 84 00 FIRESTOPPING.

3.1.6.2 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 must be installed through a 4.9 kg per square meter 16 ounce copper flashing, each within an integral skirt or flange. Flashing must be suitably formed, and the skirt or flange must extend not less than 200 mm 8 inches from the pipe and must be set over the roof or floor membrane in a solid coating of bituminous cement. The flashing must extend up the pipe a minimum of 250 mm 10 inches. For cleanouts, the flashing must be turned down into the hub and caulked after placing the ferrule. Pipes passing through pitched roofs must 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 must be sealed as indicated. Flashing for dry vents must 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 must be fitted into the sleeve clamping device. Pipes passing through wall waterproofing membrane must be sleeved as described above. A waterproofing clamping flange must be installed.

3.1.6.3 Waterproofing

****

NOTE: Drawings will detail method of attaching waterproofing membranes to sleeves passing through walls or floors that are subject to a static head of water.

****

Waterproofing at floor-mounted water closets must be accomplished by forming a flashing guard from soft-tempered sheet copper. The center of the sheet must be perforated and turned down approximately 40 mm 1-1/2 inches to fit between the outside diameter of the drainpipe and the inside diameter of the cast-iron or steel pipe sleeve. The turned-down portion of the flashing guard must be embedded in sealant to a depth of approximately 40 mm 1-1/2 inches; then the sealant must be finished off flush to floor level between the flashing guard and drainpipe. The flashing guard of sheet copper must extend not less than 200 mm 8 inches from the drainpipe and must be lapped between the floor membrane in a solid coating of bituminous cement. If cast-iron water closet floor flanges are used, the space between the pipe sleeve and drainpipe must be sealed with sealant and the flashing guard must be upturned approximately 40 mm 1-1/2 inches to fit the outside diameter of the drainpipe and the inside diameter of the water closet floor flange. The upturned portion of the sheet fitted into the floor flange must be sealed.

3.1.6.4 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.

3.1.6.5 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 must be formed around the pipe, fitting or drain. The groove must be filled with a sealant as specified in Section 07 92 00 JOINT SEALANTS.

3.1.6.6 Pipe Penetrations

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

3.1.7 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 must be provided as

specified in Section 07 84 00 FIRESTOPPING.

3.1.8 Supports

3.1.8.1 General

Hangers used to support piping 50 mm 2 inches and larger must be fabricated to permit adequate adjustment after erection while still supporting the load. Pipe guides and anchors must 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 must 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 must be used where each pipe crosses the base support member. Spacing of the base support members must not exceed the hanger and support spacing required for an individual pipe in the multiple pipe run. Threaded sections of rods must not be formed or bent.

3.1.8.2 Pipe Supports and Structural Bracing, Seismic Requirements

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

This paragraph contains tailoring for ARMY and NAVY.
****

Piping and attached valves must be supported and braced to resist seismic loads as specified in Section 13 48 73 SEISMIC CONTROL FOR MISCELLANEOUS EQUIPMENT and [Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC] [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, must be provided. Material used for supports must be as specified in[Section 05 12 00 STRUCTURAL STEEL][Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS].

3.1.8.3 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 must have the excess hanger loads suspended from panel points.
****

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

a. Types 5, 12, and 26 must not be used.

b. Type 3 must not be used on insulated pipe.

c. Type 18 inserts must 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.

d. Type 19 and 23 C-clamps must be torqued per MSS SP-58 and must have both locknuts and retaining devices furnished by the manufacturer. Field-fabricated C-clamp bodies or retaining devices are not acceptable.

e. Type 20 attachments used on angles and channels must be furnished with an added malleable-iron heel plate or adapter.

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

g. Type 39 saddles must 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 must be welded to the pipe.

h. Type 40 shields must:

(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 must have a density of 128 kg per cubic meter 8 pcf or greater.

i. Horizontal pipe supports must be spaced as specified in MSS SP-58 and a support must be installed not over 300 mm 1 foot from the pipe fitting joint at each change in direction of the piping. Pipe supports must be spaced not over 1.5 m 5 feet apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe must be 49 degrees C 120 degrees F for PVC and 82 degrees C 180 degrees F for CPVC. Horizontal pipe runs must include allowances for expansion and contraction.

j. Vertical pipe must 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 must include allowances for expansion and contraction.

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

(1) 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 that 15 degrees C 60 degrees F a Type 40 shield, attached to the pipe or

insulation, may freely rest on a steel plate.

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

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

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

3.1.8.4 Structural Attachments

Attachment to building structure concrete and masonry must be by cast-in concrete inserts, built-in anchors, or masonry anchor devices. Inserts and anchors must be applied with a safety factor not less than 5. Supports must not be attached to metal decking. Supports must 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 must be constructed of ferrous materials only.

3.1.9 Welded Installation

Plumbing pipe weldments must be as indicated. Changes in direction of piping must be made with welding fittings only; mitering or notching pipe to form elbows and tees or other similar type construction will not be permitted. Branch connection may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings must be forged, flared for improvement of flow where attached to the run, and reinforced against external strains. Beveling, alignment, heat treatment, and inspection of weld must conform to ASME B31.1. Weld defects must be removed and repairs made to the weld, or the weld joints must be entirely removed and rewelded. After filler metal has been removed from its original package, it must be protected or stored so that its characteristics or welding properties are not affected. Electrodes that have been wetted or that have lost any of their coating must not be used.

3.1.10 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 must 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 must consist of a long-sweep 1/4 bend or one or two 1/8 bends extended to the place shown. An extra-heavy cast-brass or cast-iron ferrule with countersunk cast-brass head screw plug must be caulked into the hub of the fitting and must be flush with the floor. Cleanouts in connection with other pipe, where indicated, must be T-pattern, 90-degree branch drainage fittings with

cast-brass screw plugs, except plastic plugs must be installed in plastic pipe. Plugs must be the same size as the pipe up to and including 100 mm 4 inches. Cleanout tee branches with screw plug must 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 must be provided with chromium plated bronze, nickel bronze, nickel brass or stainless steel flush type access cover plates. Round access covers must 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 must have access covers and frames installed flush with the finished wall. Cleanouts installed in finished floors subject to foot traffic must 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 must not project above the cover surface. Where cleanouts are provided with adjustable heads, the heads must be [cast iron][or][plastic].

3.1.11 Condensate Drain Piping for Tropical Environments

Condensate drain piping materials must be rated for Drain, Waste and Vent service. Above grade use[Cast Iron ASTM A74][CISPI 301][Copper Type DWV ASTM B306][or][Polyvinyl Chloride (PVC) drain, waste and vent pipe and fittings, ASTM D2665, (Sch 40) ASTM F1760]. Condensate piping must maintain a horizontal slope in the direction of discharge of not less than one-eighth unit vertical in 12 units horizontal (1 percent). Do not use PVC above grade in mechanical rooms, fire riser rooms, generator rooms or other high-abuse areas. The following condensate pipe diameters must be sized in accordance with equipment capacity refrigeration shown below:

EQUIPMENT CAPACITY	MINIMUM CONDENSATE PIPE DIAMETER
Up to 17.6 kW 5 tons	25.4 mm 1 inch
Over 17.6 kW 5 tons to 140.7 kW 40 tons	31.75 mm 1-1/4 inch
Over 140.7 kW 40 tons to 316.5 kW 90 tons	38.1 mm 1-1/2 inch
Over 316.5 kW 90 tons to 439.5 kW 125 tons	50.8 mm 2 inch
Over 439 kW 125 tons to 879.5 kW 250 tons of refrigeration	63.5 mm 2-1/2 inch

3.2 WATER HEATERS AND HOT WATER STORAGE TANKS

****
NOTE: This SUBPART is tailored for WATER HEATERS.
****

3.2.1 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 should 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 must be installed between a relief valve and its water heater or storage tank. The P&T relief valve must be installed where the valve actuator comes in contact with the hottest water in the heater. Whenever possible, the relief valve must be installed directly in a tapping in the tank or heater; otherwise, the P&T valve must be installed in the hot-water outlet piping. A vacuum relief valve must 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.

3.2.2 Installation of Gas- and Oil-Fired Water Heater

Installation must conform to NFPA 54 for gas fired and NFPA 31 for oil fired. Storage water heaters that are not equipped with integral heat traps and having vertical pipe risers must be installed with heat traps directly on both the inlet and outlet. Circulating systems need not have heat traps installed. An acceptable heat trap may be a piping arrangement such as elbows connected so that the inlet and outlet piping make vertically upward runs of not less than 600 mm 24 inches just before turning downward or directly horizontal into the water heater's inlet and outlet fittings. Commercially available heat traps, specifically designed by the manufacturer for the purpose of effectively restricting the natural tendency of hot water to rise through vertical inlet and outlet piping during standby periods may also be approved.

3.2.3 Heat Traps

****

NOTE: Piping arrangement for the heat trap should be shown on the drawings.

****

Piping to and from each water heater and hot water storage tank must be routed horizontally and downward a minimum of 610 mm 24 inches before turning in an upward direction.

3.2.4 Connections to Water Heaters

Connections of metallic pipe to water heaters must be made with dielectric unions or flanges. Use of dielectric nipples is prohibited unless internally lined and specifically designed to limit current flow between dissimilar metals.

3.2.5 Expansion Tank

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

3.2.6 Direct Fired and Domestic Water Heaters

****
NOTE: This paragraph is also tailored for NAVY. 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 3-430-07, "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.

3.3 FIXTURES AND FIXTURE TRIMMINGS

****
NOTE: This paragraph is tailored for FIXTURES.
****

Polished chromium-plated pipe, valves, and fittings must 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 must be furnished and installed with fixtures. Where connections between copper tubing and faucets are made by rubber compression fittings, a beading tool must be used to mechanically deform the tubing above the compression fitting. Exposed traps and supply pipes for fixtures and equipment must be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall escutcheons must be as specified. Drain lines and hot water lines of fixtures for handicapped personnel must be insulated and do not require polished chrome finish. Plumbing fixtures and accessories must be installed within the space shown.

3.3.1 Fixture Connections

****
NOTE: This paragraph is tailored for FIXTURES.
****

Where space limitations prohibit standard fittings in conjunction with the cast-iron floor flange, special short-radius fittings must be provided. Connections between earthenware fixtures and flanges on soil pipe must 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 must 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.

3.3.2 Flushometer Valves

****

NOTE: This paragraph is tailored for FIXTURES. Include bracketed requirement for water closets in male barracks and dormitories. Bumpers for water closet seat on flushometer spud work only with closed front seat. Delete sentence describing location of flush valve handle when an automatic flushing system is provided.

****

Flushometer valves must 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 must be installed 1 m 39 inches above the floor, except at water closets intended for use by the physically handicapped where flushometer valves must be mounted at approximately 760 mm 30 inches above the floor and arranged to avoid interference with grab bars. In addition, for water closets intended for handicap use, the flush valve handle must be installed on the wide side of the enclosure.][Bumpers for water closet seats must be installed on the[wall][flushometer stop][flushometer spud].]

3.3.3 Height of Fixture Rims Above Floor

****

NOTE: This paragraph is tailored for FIXTURES.

****

Lavatories must be mounted with rim 775 mm 31 inches above finished floor. Wall-hung drinking fountains and water coolers must be installed with rim 1020 mm 42 inches above floor. Wall-hung service sinks must be mounted with rim 700 mm 28 inches above the floor. Installation of fixtures for use by the physically handicapped must be in accordance with ICC A117.1.

3.3.4 Shower Bath Outfits

****

NOTE: This paragraph is tailored for FIXTURES.

****

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

3.3.5 Fixture Supports

****

NOTE: This subpart is tailored for FIXTURES. 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, must be of the chair-carrier type. The carrier must provide the necessary means of mounting the fixture, with a foot or feet to anchor the assembly to the floor slab. Adjustability must be provided to locate the fixture at the desired height and in proper relation to the wall. Support plates, in lieu of chair carrier, must be fastened to the wall structure only where

it is not possible to anchor a floor-mounted chair carrier to the floor slab.

3.3.5.1 Support for Solid Masonry Construction

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

3.3.5.2 Support for Concrete-Masonry Wall Construction

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

3.3.5.3 Support for Steel Stud Frame Partitions

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

3.3.5.4 Support for Wood Stud Construction

Where floor is a concrete slab, a floor-anchored chair carrier must be used. Where entire construction is wood, wood crosspieces must be installed. Fixture hanger plates, supports, brackets, or mounting lugs must 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 must extend the full width of the fixture and must be securely supported.

3.3.5.5 Wall-Mounted Water Closet Gaskets

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

3.3.6 Backflow Prevention Devices

****

NOTE: This paragraph contains tailoring for AIR FORCE, ARMY, and NAVY. The Air Force uses the Uniform Plumbing Code, for Air Force jobs backflow prevention equipment and installation must meet the UPC code.

****

Plumbing fixtures, equipment, and pipe connections must not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers must 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 must 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 must be located so that no part of the device will be submerged. Backflow preventers must 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 must not be provided around backflow preventers. Access must be provided for maintenance and testing. Each device must be a standard commercial unit.

3.3.7 Access Panels

****
NOTE: This paragraph is tailored for FIXTURES.
****

Access panels must be provided for concealed valves and controls, or any item requiring inspection or maintenance. Access panels must be of sufficient size and located so that the concealed items may be serviced, maintained, or replaced. Access panels must be as specified in[Section 08 31 00 ACCESS DOORS AND PANELS][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS].

3.3.8 Sight Drains

****
NOTE: This paragraph is tailored for PIPING.
****

Sight drains must 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.

3.3.9 Traps

****
NOTE: This paragraph is tailored for PIPING.
****

Each trap must be placed as near the fixture as possible, and no fixture must be double-trapped. Traps installed on cast-iron soil pipe must be cast iron. Traps installed on steel pipe or copper tubing must 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 must be of the same material as the pipe.

3.3.10 Shower Pans

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

3.3.10.1 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, must be made watertight with a shower pan fabricated in place. The shower pan material must 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 must be folded over the curb with an approximate return of 1/4 of curb height. The upstands must be placed behind any wall or partition finish. Subflooring must be smooth and clean, with nailheads driven flush with surface, and must be sloped to drain. Shower pans must be clamped to drains with the drain clamping ring.

3.3.10.2 Metal Shower Pans

When a shower pan of required size cannot be furnished in one piece, metal pieces must be joined with a flintlock seam and soldered or burned. The corners must be folded, not cut, and the corner seam must be soldered or burned. Pans, including upstands, must be coated on all surfaces with one brush coat of asphalt. Asphalt must 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 must be placed between shower pans and wood floors. The joining surfaces of metal pan and drain must be given a brush coat of asphalt after the pan is connected to the drain.

3.3.10.3 Plasticized Chlorinated Polyethylene Shower Pans

Corners of plasticized chlorinated polyethylene shower pans must be folded against the upstand by making a pig-ear fold. Hot-air gun or heat lamp must be used in making corner folds. Each pig-ear corner fold must be nailed or stapled 12 mm 1/2 inch from the upper edge to hold it in place. Nails must be galvanized large-head roofing nails. On metal framing or studs, approved duct tape must be used to secure pig-ear fold and membrane. Where no backing is provided between the studs, the membrane slack must be taken up by pleating and stapling or nailing to studding 12 mm 1/2 inch from upper edge. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it will be applied must be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane must be pressed into place. Surfaces to be solvent-welded must be clean. Surfaces to be joined with xylene must be initially sprayed and vigorously cleaned with a cotton cloth, followed by final coating of xylene and the joining of the surfaces by roller or equivalent means. If ambient or membrane temperatures are below 4 degrees C 40 degrees F the membrane and the joint must be heated prior to application of xylene. Heat may be applied with hot-air gun or heat lamp, taking precautions not to scorch the membrane. Adequate ventilation and wearing of gloves are required when working with xylene. Membrane must be pressed into position on the drain body, and must be cut and fit to match so that membrane can be properly clamped and an effective gasket-type seal provided. On wood subflooring, two layers of 0.73 kg per square meter 15 pound dry felt must be installed prior to installation of shower pan to ensure a smooth surface for installation.

3.3.10.4 Nonplasticized Polyvinyl Chloride (PVC) Shower Pans

Nonplasticized PVC must be turned up behind walls or wall surfaces a distance of not less than 150 mm 6 inches in room areas and 75 mm 3 inches above curb level in curbed spaces with sufficient material to fold over and fasten to outside face of curb. Corners must be pig-ear type and folded between pan and studs. Only top 25 mm 1 inch of upstand must be nailed to hold in place. Nails must be galvanized large-head roofing type. Approved duct tape must be used on metal framing or studs to secure pig-ear fold and membrane. Where no backing is provided between studs, the membrane slack must be taken up by pleating and stapling or nailing to studding at top inch of upstand. To adhere the membrane to vertical surfaces, the back of the membrane and the surface to which it is to be

applied must be coated with adhesive that becomes dry to the touch in 5 to 10 minutes, after which the membrane must be pressed into place. Trim for drain must be exactly the size of drain opening. Bolt holes must be pierced to accommodate bolts with a tight fit. Adhesive must be used between pan and subdrain. Clamping ring must be bolted firmly. A small amount of gravel or porous materials must be placed at weepholes so that holes remain clear when setting bed is poured. Membrane must be solvent welded with PVC solvent cement. Surfaces to be solvent welded must be clean (free of grease and grime). Sheets must be laid on a flat surface with an overlap of about 50 mm 2 inches. Top edge must be folded back and surface primed with a PVC primer. PVC cement must be applied and surfaces immediately placed together, while still wet. Joint must be lightly rolled with a paint roller, then as the joint sets must be rolled firmly but not so hard as to distort the material. In long lengths, about 600 or 900 mm 2 or 3 feet at a time must be welded. On wood subflooring, two layers of 0.73 kg per square meter 15 pound felt must be installed prior to installation of shower pan to ensure a smooth surface installation.

3.4 VIBRATION-ABSORBING FEATURES

****

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.

This paragraph contains tailoring for PUMPS and PIPING.

****

Mechanical equipment, including compressors and pumps, must be isolated from the building structure by approved vibration-absorbing features, unless otherwise shown. Submit details of vibration-absorbing features, including arrangement, foundation plan, dimensions and specifications. Each foundation must include an adequate number of standard isolation units. Each unit must consist of machine and floor or foundation fastening, together with intermediate isolation material, and must be a

standard product with printed load rating. Piping connected to mechanical equipment must be provided with flexible connectors. Isolation unit installation must limit vibration to [_____] percent of the lowest equipment rpm.

3.4.1 Tank- or Skid-Mounted Compressors

****
NOTE: This paragraph is tailored for COMPRESSED AIR SYSTEM and also contains tailoring for ARMY.
****

Floor attachment must be as recommended by compressor manufacturer. Compressors must be mounted to resist seismic loads as specified in Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC.

3.4.2 Foundation-Mounted Compressors

****
NOTE: This paragraph is tailored for COMPRESSED AIR SYSTEM and also contains tailoring for ARMY.
****

[Foundation attachment must be as recommended by the compressor manufacturer.][Foundation must be as recommended by the compressor manufacturer, except the foundation must weigh not less than three times the weight of the moving parts.]Compressors must be mounted to resist seismic loads as specified in Section 23 05 48.19 [SEISMIC] BRACING FOR HVAC.

3.5 WATER METER REMOTE READOUT REGISTER

The remote readout register must be mounted at the location indicated or as directed by the Contracting Officer.

3.6 IDENTIFICATION SYSTEMS

3.6.1 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 must be installed on valves, except those valves installed on supplies at plumbing fixtures. Tags must be 35 mm 1-3/8 inch minimum diameter, and marking must be stamped or engraved. Indentations must be black, for reading clarity. Tags must be attached to valves with No. 12 AWG, copper wire, chrome-plated beaded chain, or plastic straps designed for that purpose.

3.6.2 Pipe Color Code Marking

****
NOTE: Designer will coordinate color code marking with Section 09 90 00 PAINTS AND COATINGS. 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 must be as specified in Section 09 90 00 PAINTS AND COATINGS.

3.6.3 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 must be provided in buildings having suspended grid ceilings. The color coding scheme must 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 must include valves, dampers, switches, linkages and thermostats. The color coding scheme must consist of a color code board and colored metal disks. Each colored metal disk must be approximately 12 mm 3/8 inch in diameter and secured to removable ceiling panels with fasteners. The fasteners must be inserted into the ceiling panels so that the fasteners will be concealed from view. The fasteners must be manually removable without tools and must not separate from the ceiling panels when panels are dropped from ceiling height. Installation of colored metal disks must follow completion of the finished surface on which the disks are to be fastened. The color code board must have the approximate dimensions of 1 m 3 foot width, 750 mm 30 inches height, and 12 mm 1/2 inch thickness. The board must 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 must be approximately 20 mm 3/4 inch in diameter and the related lettering in 12 mm 1/2 inch high capital letters. The color code board must be mounted and located in the mechanical or equipment room. The color code system must be as indicated below:

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

3.7 ESCUTCHEONS

****

NOTE: This SUBPART is tailored for PIPING.

****

Escutcheons must 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 must be fastened securely to pipe or pipe covering and must be satin-finish, corrosion-resisting steel, polished chromium-plated zinc alloy, or polished chromium-plated copper alloy. Escutcheons must be either one-piece or split-pattern, held in place by internal spring tension or setscrew.

3.8 PAINTING

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.

3.8.1 Painting of New Equipment

New equipment painting must be factory applied or shop applied, and must be as specified herein, and provided under each individual section.

3.8.1.1 Factory Painting Systems

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 must withstand 500 hours in a salt-spray fog test. Salt-spray fog test must be in accordance with ASTM B117, and for that test the acceptance criteria must be as follows: immediately after completion of the test, the paint must show no signs of blistering, wrinkling, or cracking, and no loss of adhesion; and the specimen must show no signs of rust creepage beyond 3 mm 0.125 inch on either side of the scratch mark.

The film thickness of the factory painting system applied on the equipment must 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 must be designed for the temperature service.

3.8.1.2 Shop Painting Systems for Metal Surfaces

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 must be cleaned to bare metal.

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 must be aluminum or light gray.

a. Temperatures Less Than 50 Degrees C 120 Degrees F: Immediately after cleaning, the metal surfaces subject to temperatures less than 50 degrees C 120 degrees F must 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.

b. Temperatures Between 50 and 205 Degrees C 120 and 400 Degrees F: Metal surfaces subject to temperatures between 50 and 205 degrees C 120 and 400 degrees F must 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.

c. Temperatures Greater Than 205 Degrees C 400 Degrees F: Metal surfaces subject to temperatures greater than 205 degrees C 400 degrees F must

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.

3.9 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/CAN 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/CAN 61 immediately upon beneficial occupancy.
****

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 must indicate the final position of controls.

3.9.1 Plumbing System

****
NOTE: This paragraph is tailored for PIPING and also contains tailoring for AIR FORCE, ARMY, and NAVY.

NOTE: The Air Force uses the Uniform Plumbing Code, for Air Force jobs backflow prevention equipment and installation must meet the UPC code.
****

The following tests must be performed on the plumbing system in accordance with [ICC IPC][IAPMO UPC], except that the drainage and vent system final test must 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, the Contractor must submit a testing procedure and reasons for choosing this option in lieu of the smoke test to the Contracting Officer for approval.

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

b. Building Sewers Tests.

c. Water Supply Systems Tests.

3.9.1.1 Test of Backflow Prevention Assemblies

Certification of proper operation must be submitted and must be as accomplished in accordance with state regulations by an individual certified by the state to perform such tests. If no state requirement exists, the Contractor must have the manufacturer's representative test the device to ensure the unit is properly installed and performing as intended. The Contractor must provide written documentation of the tests performed and signed by the individual performing the tests. Backflow prevention assembly must be tested using gauges specifically designed for

the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges must be tested annually for accuracy in accordance with the requirements of State or local regulatory agencies. If there is no State or local regulatory agency requirements, gauges must be tested annually for accuracy in accordance with the requirements of 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), or any other approved testing laboratory having equivalent capabilities for both laboratory and field evaluation of backflow prevention assembly test gauges. Report form for each assembly must 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 must be repaired and retested.

3.9.1.2 Shower Pans

After installation of the pan and finished floor, the drain must be temporarily plugged below the weep holes. The floor area must 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.

3.9.1.3 Compressed Air Piping (Nonoil-Free)

****
NOTE: This paragraph is tailored for COMPRESSED AIR SYSTEM.
****

Piping systems must be filled with oil-free dry air or gaseous nitrogen to 1.03 MPa 150 psig and hold this pressure for 2 hours with no drop in pressure.

3.9.2 Defective Work

****
NOTE: This paragraph contains tailoring for PIPING.
****

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

3.9.3 System Flushing

****
NOTE: This subpart is tailored for PIPING.
****

3.9.3.1 During Flushing

****
NOTE: Hot water flushing dissolves most excess petrolatum-based flux inside piping, helping to avoid future corrosion problems.
****

Before operational tests or disinfection, potable water piping system must be flushed with [hot]potable water. Sufficient water must 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) must specify the number of fixtures to be operated during flushing. Contractor must 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 must be responsible for any flood damage resulting from flushing of the system. Flushing must 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/CAN 61, Section 9, must be flushed a minimum of 1 L 0.25 gallons per 24 hour period, ten times over a 14 day period.

3.9.3.2 After Flushing

System must be drained at low points. Strainer screens must be removed, cleaned, and replaced. After flushing and cleaning, systems must 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 must be repaired by the Contractor. When the system flushing is complete, the hot-water system must be adjusted for uniform circulation. Flushing devices and automatic control systems must be adjusted for proper operation according to manufacturer's instructions. Flow rates on fixtures must not exceed those stated in PART 2 of this Section. Unless more stringent local requirements exist, lead levels must not exceed limits established by 40 CFR 141.80 (c)(1). The water supply to the building must be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

3.9.4 Operational Test

****
NOTE: The following list contains tailoring: Items b. and c. are tailored for FIXTURES; Item e. is tailored for PUMPS; Item f. is tailored for WATER HEATERS, Items g. and h. are tailored for PIPING; Item i. is tailored for PRESSURE PIPING; and Item j. is tailored for COMPRESSED AIR SYSTEM.
****

Upon completion of flushing and prior to disinfection procedures, the Contractor must subject the plumbing system to operating tests to demonstrate satisfactory installation, connections, adjustments, and functional and operational efficiency. Such operating tests must cover a period of not less than 8 hours for each system and must 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.

j. Compressed air readings at each compressor and at each outlet. Each indicating instrument must be read at 1/2 hour intervals. The report of the test must be submitted in quadruplicate. The Contractor must furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

3.9.5 Disinfection

****
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. For Army-only projects, use EPA SM 9223. For Navy-only projects, use AWWA 10084.

****

After all system components are provided and operational tests are complete, the entire domestic hot- and cold-water distribution system must be disinfected. Before introducing disinfecting chlorination material, entire system must be flushed with potable water until any entrained dirt and other foreign materials have been removed.

****

NOTE: The following paragraph contains tailoring for PIPING and PUMPS.

****

Water chlorination procedure must be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material must be hypochlorites or liquid chlorine. The chlorinating material must be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). Feed a properly adjusted hypochlorite solution injected into the system with a hypochlorinator, or inject liquid chlorine into the system through a solution-feed chlorinator and booster pump until the entire system is completely filled.

3.9.5.1 Water Chlorination Monitoring

Test the chlorine residual level in the water at 6 hour intervals for a continuous period of 24 hours. If at the end of a 6 hour interval, the chlorine residual has dropped to less than 25 ppm, flush the piping including tanks with potable water, and repeat the above chlorination procedures. During the chlorination period, each valve and faucet must be opened and closed several times. After the second 24 hour period, verify that no less than 25 ppm chlorine residual remains in the treated system. The 24 hour chlorination procedure must be repeated until no less than 25 ppm chlorine residual remains in the treated system.

3.9.5.2 Water Chlorination Flushing

Upon the specified verification, the system including tanks must then be flushed with potable water until the residual chlorine level is reduced to less than one part per million. During the flushing period, each valve and faucet must be opened and closed several times.

3.9.5.3 Sample Testing

Take additional samples of water in disinfected containers, for bacterial examination, at locations specified by the Contracting Officer. Test these samples for total coliform organisms (coliform bacteria, fecal coliform, streptococcal, and other bacteria) in accordance with[EPA SM 9223][AWWA 10084]. The testing method used must be EPA approved for drinking water systems and must comply with applicable local and state requirements.

3.9.5.4 Disinfection Acceptance

Disinfection must be repeated until bacterial 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.

[3.9.6 OPTIONAL DISINFECTION METHOD

****
NOTE: This paragraph is tailored for NAVY. For Iceland projects only, include the following option.
****

Disinfect new potable water piping and affected portions of existing potable water piping with geothermal water. Geothermal water must be not less than 90 degrees C 194 degrees F and contact time must 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 2 hours.

]3.10 POSTED INSTRUCTIONS

Framed instructions under glass or in laminated plastic, including wiring and control diagrams showing the complete layout of the entire system, must 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 must be prepared in typed form, framed as specified above for the wiring and control diagrams and posted beside the diagrams. The framed instructions must be posted before acceptance testing of the systems.

3.11 PERFORMANCE OF WATER HEATING EQUIPMENT

****
NOTE: This SUBPART is tailored for WATER HEATERS.
****

Standard rating condition terms are as follows:

DP = Draw pattern

EF = Energy factor, minimum overall efficiency.

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

SL = Standby loss is maximum (Btu/h) based on a 21 degrees C 70 degrees F temperature difference between stored water and ambient requirements.

UEF = Uniform energy factor

V = Rated volume in gallons

Q = Nameplate input rate in kW (Btu/h)

3.11.1 Storage Water Heaters

3.11.1.1 Electric

a. Storage capacity more than or equal to 75.7 liters 20 gallons and less

than or equal to 208 liters 55 gallons with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.8808 - (0.0008 x V), low must have a uniform energy factor (UEF) of 0.9254 - (0.0003 x V), medium must have a uniform energy factor (UEF) of 0.9307 - (0.0002 x V), high must have a uniform energy factor (UEF) of 0.9349 - (0.0001 x V) per 10 CFR 430.

b. Storage capacity more than 208 liters 55 gallons and less than or equal to 454 liters 120 gallons with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 1.9236 - (0.0011 x V), low must have a uniform energy factor (UEF) of 2.0440 - (0.0011 x V), medium must have a uniform energy factor (UEF) of 2.1171 - (0.0011 x V), high must have a uniform energy factor (UEF) of 2.418 - (0.0011 x V) per 10 CFR 430.

3.11.1.2 Gas

a. Storage capacity more than or equal to 75.7 liters 20 gallons and less than or equal to 208 liters 55 gallons with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.3456 - (0.0020 x V), low must have a uniform energy factor (UEF) of 0.5982 - (0.0019 x V), medium must have a uniform energy factor (UEF) of 0.6483 - (0.0017 x V), high must have a uniform energy factor (UEF) of 0.6920 - (0.0013 x V) per 10 CFR 430.

b. Storage capacity more than 208 liters 55 gallons and less than or equal to 378.5 liters 100 gallons with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.6470 - (0.0006 x V), low must have a uniform energy factor (UEF) of 0.7689 - (0.0005 x V), medium must have a uniform energy factor (UEF) of 0.7897 - (0.0004 x V), high must have a uniform energy factor (UEF) of 0.8702 - (0.0003 x V) per 10 CFR 430.

c. Storage capacity less than or equal to 454 liters 120 gallons with input rating more than 22980 W 75,000 Btu/h and less than 30773 W 105,000 Btu/h with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.2674 - (0.0009 x V), low must have a uniform energy factor (UEF) of 0.5362 - (0.0012 x V), medium must have a uniform energy factor (UEF) of 0.6002 - (0.0011 x V), high must have a uniform energy factor (UEF) of 0.6597 - (0.0009 x V) per 10 CFR 430.

3.11.1.3 Oil

a. Storage capacity less than or equal to 189 liters 50 gallons with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.2509 - (0.0012 x V), low must have a uniform energy factor (UEF) of 0.5330 - (0.0016 x V), medium must have a uniform energy factor (UEF) of 0.6078 - (0.0016 x V), high must have a uniform energy factor (UEF) of 0.6815 - (0.0014 x V) per 10 CFR 430.

b. Storage capacity less than or equal to 454 liters 120 gallons with input rating more than 30773 W 105,000 Btu/h and less than or equal to 41030 W 140,000 Btu/h with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.2932 - (0.0015 x V), low must have a uniform energy factor (UEF) of 0.5596 - (0.0018 x V), medium must have a uniform energy factor (UEF) of 0.6194 - (0.0016 x V), high must have a uniform energy factor (UEF) of 0.6740 - (0.0013 x V) per 10 CFR 430.

3.11.2 Unfired Hot Water Storage

All volumes and inputs: must meet or exceed R-12.5.

3.11.3 Instantaneous Water Heater

3.11.3.1 Electric

a. Storage capacity less than 7.57 liters 2 gallons with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.91, low must have a uniform energy factor (UEF) of 0.91, medium must have a uniform energy factor (UEF) of 0.91, high must have a uniform energy factor (UEF) of 0.92 per 10 CFR 430.

3.11.3.2 Gas

a. Storage capacity less than 7.57 liters 2 gallons input rating greater than 14654 W 50,000 Btu/h with a draw pattern (DP) of: very small must have a uniform energy factor (UEF) of 0.80, low must have a uniform energy factor (UEF) of 0.81, medium must have a uniform energy factor (UEF) of 0.81, high must have a uniform energy factor (UEF) of 0.81 per 10 CFR 430.

b. Rating of 309.75 W/L 4,000 Btu/h/gal and storage capacity less than 37.85 L 10 gallons with an input of 58.62 kW 200,000 Btu/h must have a minimum thermal efficiency (ET) of 80 percent per ANSI Z21.10.3/CSA 4.3.

c. Rating of 309.75 W/L 4,000 BTU/h/gal and storage capacity more than 37.85 L 10 gallons with an input more than 58.62 kW 200,000 Btu/h must have a minimum thermal efficiency (ET) of 80 percent and the maximum SL must be Q/800+110x(V^^1/2)) per ANSI Z21.10.3/CSA 4.3.

3.11.3.3 Oil

a. Rating of 309.75 W/L 4,000 Btu/h/gal and storage capacity less than 7.57 L 2 gallons with an input more than 14.7 kW 50,000 Btu/h and less than 61.55 kW 210,000 Btu/h must have an energy factor (EF) of0.59 - (0.0005 x V per 10 CFR 430.

b. Rating of 309.75 W/L 4,000 Btu/h/gal and storage capacity less than 37.85 L 10 gallons with an input more than 37.85 L 10 gallons with an input more than 61.55 kW 210,000 Btu/h must have a minimum thermal efficiency (ET) of 80 percent per ANSI Z21.10.3/CSA 4.3.

c. Rating of 309.75 W/L 4,000 Btu/h/gal and storage capacity more than 37.85 L 10 gallons with an input of more than 61.55 kW 210,000 Btu/h must have a minimum thermal efficiency (ET) of 78 percent and the maximum SL must be Q/800+110x(V^^1/2)) per ANSI Z21.10.3/CSA 4.3.

3.11.4 Pool Heaters

a. Gas/oil fuel, capacities and inputs: ET must be 78 percent per ASHRAE 146.

b. Heat Pump, All capacities and inputs must meet a COP of 4.0 per ASHRAE 146

3.12 TABLES

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NOTE: TABLE I is tailored for PIPING.

NOTE: Corrosive waste, indicated in column F of Table I below, is a broad category; how well a pipe material will respond to a specific application will depend on the type of waste and its concentration. Column F was developed based on corrosive waste typically found at military or civil works facilities, e.g., battery acid at normal concentration levels. The designer should consider each specific application and research which type of pipe would work best. To help, The Plastic Pipe Institute published a report titled "TR-19/2020 Chemical Resistance of Plastic Piping Materials" that contains a data table listing the chemical resistance of piping located at web site: http://www.plasticpipe.org/common/Uploaded%20files/Technical/tr-19.pdf

Use copper condensate drain piping on any equipment that utilizes R-410A refrigerant or any refrigerant that contains polyolester lubricating oil. Add working pressure ratings for plastic pipe after material description in Table I.

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TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
1	Cast iron soil pipe and fittings, hub and spigot, ASTM A74 with compression gaskets. Pipe and fittings must be marked with the CISPI trademark.	X	X	X	X	X		

TABLE I								
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS								
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
2	Cast iron soil pipe and fittings hubless, CISPI 301 and ASTM A888. Pipe and fittings must be marked with the CISPI trademark.		X		X	X		
3	Cast iron drainage fittings, threaded, ASME B16.12 for use with Item 10	X		X	X			
4	Cast iron screwed fittings (threaded) ASME B16.4 for use with Item 10				X	X		
5	Grooved pipe couplings, ferrous and non-ferrous pipe ASTM A536 And ASTM A47/A47M	X	X		X	X		
6	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M for use with Item 5	X	X		X	X		

TABLE I								
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS								
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
7	Bronze sand casting grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 5	X	X		X	X		
8	Wrought copper grooved joint pressure fittings for non-ferrous pipe ASTM B75/B75M C12200, ASTM B152/B152M, C11000, ASME B16.22 ASME B16.22 for use with Item 5	X	X					
9	Malleable-iron threaded fittings, galvanized ASME B16.3 for use with Item 10				X	X		
10	Steel pipe, seamless galvanized, ASTM A53/A53M, Type S, Grade B				X	X		
11	Seamless red brass pipe, ASTM B43				X	X		X

TABLE I								
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS								
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
12	Bronzed flanged fittings, ASME B16.24 for use with Items 11 and 14				X	X		X
13	Cast copper alloy solder joint pressure fittings, ASME B16.18for use with Item 14				X	X		X
14	Seamless copper pipe, ASTM B42						X	X
15	Cast bronze threaded fittings, ASME B16.15				X	X		
16	Copper drainage tube, (DWV), ASTM B306	X*	X	X*	X	X		X
17	Wrought copper and wrought alloy solder-joint drainage fittings. ASME B16.29	X	X	X	X	X		X
18	Cast copper alloy solder joint drainage fittings, DWV, ASME B16.23	X	X	X	X	X		X

TABLE I								
PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS								
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
19	Acrylonitrile-Butadiene -Styrene (ABS) plastic drain, waste, and vent pipe and fittings ASTM D2661, ASTM F628	X	X	X	X	X	X	
20	Polyvinyl Chloride plastic drain, waste and vent pipe and fittings, ASTM D2665, ASTM F891, (Sch 40) ASTM F1760	X	X	X	X	X	X	X
21	Process glass pipe and fittings, ASTM C1053						X	
22	High-silicon content cast iron pipe and fittings (hub and spigot, and mechanical joint), ASTM A518/A518M		X			X	X	
23	Polypropylene (PP) waste pipe and fittings, ASTM D4101						X	
24	Filament-wound reinforced thermosetting resin (RTRP) pipe, ASTM D2996						X	

TABLE I

PIPE AND FITTING MATERIALS FOR DRAINAGE, WASTE, VENT AND CONDENSATE DRAIN PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D	SERVICE E	SERVICE F	SERVICE G
25	Cast Iron pipe and fittings, CEN EN 877 piping	X	X	X	X	X	X	

SERVICE:

A - Underground Building Soil, Waste and Storm Drain
B - Aboveground Soil, Waste, Drain In Buildings
C - Underground Vent
D - Aboveground Vent
E - Interior Rainwater Conductors Aboveground
F - Corrosive Waste And Vent Above And Belowground
G - Condensate Drain Aboveground

* - Hard Temper

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NOTE: TABLE II is tailored for PRESSURE PIPING.

NOTE: If PEX is used, tube I.D. sizes are to be copper equivalent I.D. sizes. PEX is not to be used on Navy, Marine Corps, and Air Force projects.

For Navy, Marine Corps, and Army projects, coordinate with the user on the use of item 38 (Press Fittings) in TABLE II below.

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TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
1	Malleable-iron threaded fittings:				
	a. Not galvanized for use with Item 4b			X	
2	Grooved pipe couplings, ferrous pipe ASTM A536 and ASTM A47/A47M, non-ferrous pipe, ASTM A536 and ASTM A47/A47M	X	X	X	
3	Ductile iron grooved joint fittings for ferrous pipe ASTM A536 and ASTM A47/A47M, for use with Item 2	X	X	X	
4	Steel pipe:				
	a. Seamless, black, ASTM A53/A53M, Type S, Grade B			X	
5	Seamless red brass pipe, ASTM B43	X	X		X
6	Bronze flanged fittings, ASME B16.24 for use with Items 5 and 7	X	X		X
7	Seamless copper pipe, ASTM B42	X	X		X
8	Seamless copper water tube, ASTM B88, ASTM B88M	X**	X**	X**	X***
9	Cast bronze threaded fittings, ASME B16.15 for use with Items 5 and 7	X	X		X
10	Wrought copper and bronze solder-joint pressure fittings, ASME B16.22 for use with Items 5, 7 and 8	X	X	X	X

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
11	Cast copper alloy solder-joint pressure fittings, ASME B16.18 for use with Item 8	X	X	X	X
12	Bronze and sand castings grooved joint pressure fittings for non-ferrous pipe ASTM B584, for use with Item 2	X	X	X	
13	Polyethylene (PE) plastic pipe, Schedules 40 and 80, based on outside diameter	X			X
14	Polyethylene (PE) plastic pipe (SDR-PR), based on controlled outside diameter, ASTM D3035	X			X
15	Polyethylene (PE) plastic pipe (SIDR-PR), based on controlled inside diameter, ASTM D2239	X			X
16	Butt fusion polyethylene (PE) plastic pipe fittings, ASTM D3261 for use with Items 14, 15, and 16	X			X
17	Socket-type polyethylene fittings for outside diameter-controlled polyethylene pipe, ASTM D2683 for use with Item 15	X			X
18	Polyethylene (PE) plastic tubing, ASTM D2737	X			X
19	Chlorinated polyvinyl chloride (CPVC) plastic hot and cold water distribution system, ASTM D2846/D2846M	X	X		X
20	Chlorinated polyvinyl chloride (CPVC) plastic pipe, Schedule 40 and 80, ASTM F441/F441M	X	X		X

TABLE II					
PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS					
Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
21	Chlorinated polyvinyl chloride (CPVC) plastic pipe (SDR-PR) ASTM F442/F442M	X	X		X
22	Threaded chlorinated polyvinyl chloride (chloride CPVC) plastic pipe fittings, Schedule 80, ASTM F437, for use with Items 20, and 21	X	X		X
23	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings, Schedule 40, ASTM F438 for use with Items 20, 21, and 22	X	X		X
24	Socket-type chlorinated polyvinyl chloride (CPVC) plastic pipe fittings Schedule 80, ASTM F439 for use with Items 20, 21, and 22	X	X		X
25	Polyvinyl chloride (PVC) plastic pipe, Schedules 40, 80, and 120, ASTM D1785	X			X
26	Polyvinyl chloride (PVC) pressure-rated pipe (SDR Series), ASTM D2241	X			X
27	Polyvinyl chloride (PVC) plastic pipe fittings, Schedule 40, ASTM D2466	X			X
28	Socket-type polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2467 for use with Items 26 and 27	X			X
29	Threaded polyvinyl chloride (PVC) plastic pipe fittings, schedule 80, ASTM D2464	X			X
30	Joints for IPS PVC pipe using solvent cement, ASTM D2672	X			X

TABLE II

PIPE AND FITTING MATERIALS FOR PRESSURE PIPING SYSTEMS

Item #	Pipe and Fitting Materials	SERVICE A	SERVICE B	SERVICE C	SERVICE D
31	Polypropylene (PP) plastic pipe and fittings; ASTM F2389	X	X		X
32	Steel pipeline flanges, MSS SP-44	X	X		
33	Fittings: brass or bronze; ASME B16.15, and ASME B16.18 ASTM B828	X	X		
34	Carbon steel pipe unions, socket-welding and threaded, MSS SP-83	X	X	X	
35	Malleable-iron threaded pipe unions ASME B16.39	X	X		
36	Nipples, pipe threaded ASTM A733	X	X	X	
37	Crosslinked Polyethylene (PEX) Plastic Pipe ASTM F877	X	X		X
38	Press Fittings	X	X		

SERVICE:
A - Cold Water Service Aboveground
B - Hot and Cold Water Distribution 82 degrees C
180 degrees F Maximum Aboveground
C - Compressed Air Lubricated
D - Cold Water Service Belowground
Indicated types are minimum wall thicknesses.
** - Type L - Hard
*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors
**** - In or under slab floors only brazed joints

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NOTE: TABLE III is tailored for WATER HEATERS.

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TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
A. STORAGE WATER HEATERS					
Elect.	≥75.7 L and ≤208 L		10 CFR 430	DP	UEF
				Very Small	0.8808 - (0.0008 x V)
				Low	0.9254 - (0.0003 x V)
				Medium	0.9307 - (0.0002 x V)
				High	0.9349 - (0.0001 x V)
Elect.	>208 L and ≤ 454 L		10 CFR 430	DP	UEF
				Very Small	1.9236 - (0.0011 x V)
				Low	2.0440 - (0.0011 x V)
				Medium	2.1171 - (0.0011 x V)
				High	2.2418 - (0.0011 x V)

TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
Elect.		≤24 Amps and ≤250 Volts	10 CFR 430	Rating Condition	UEF
				Integrated heat pump water heater (HPWH)	UEF ≥3.3 and First Hour Rating ≥170 L/h
				Integrated HPWH, >120 V/15 Amp Circuit or Split-system HPWH	UEF ≥2.2 and First Hour Rating ≥170 L/h
Elect. Heat Pump		>12 kW	10 CFR 430	HPWH COP ≥3.0	
Gas	≥75.7 L and ≤208 L		10 CFR 430	DP	UEF
				Very Small	0.3456 - (0.0020 x V)
				Low	0.5982 - (0.0019 x V)
				Medium	0.6483 - (0.0017 x V)
				High	0.6920 - (0.0013 x V)
Gas	>208 L and ≤ 378.5 L		10 CFR 430	DP	UEF
				Very Small	0.6470 - (0.0006 x V)
				Low	0.7689 - (0.0005 x V)
				Medium	0.7897 - (0.0004 x V)
				High	0.8072 - (0.0003 x V)

TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
Gas	≤454 L	>22 kW	10 CFR 430	DP	UEF
				Very Small	0.2674 - (0.0009 x V)
				Low	0.5362 - (0.0012 x V)
				Medium	0.6002 - (0.0011 x V)
				High	0.6597 - (0.0009 x V)
Oil	≤189 L		10 CFR 430	DP	UEF
				Very Small	0.2509 - (0.0012 x V)
				Low	0.5330 - (0.0016 x V)
				Medium	0.6078 - (0.0016 x V)
				High	0.6815 - (0.0014 x V)
Oil	≤454 L	>30.8 kW and ≤41 kW	10 CFR 430	DP	UEF
				Very Small	0.2932 - (0.0015 x V)
				Low	0.5596 - (0.0018 x V)
				Medium	0.6194 - (0.0016 x V)
				High	0.6740 - (0.0013 x V)
B. Unfired Hot Water Storage, R = 2.2 minimum					
C. Instantaneous Water Heater					
Elect.	<7.6 L		10 CFR 430	DP	UEF
				Very Small	0.91
				Low	0.91
				Medium	0.91
				High	0.92

TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
Gas	<7.6 L and >14.7 kW		10 CFR 430	DP	UEF
				Very Small	0.80
				Low	0.81
				Medium	0.81
				High	0.81
Gas	309.75 W/L min. and 37.85 L max.	58.62 kW min.	ANSI Z21.10.3,	ET = 80 percent	
Gas	309.75 W/L min. and 37.85 L max.	58.62 kW min.	ANSI Z21.10.3,	ET = 80 percent and SL + (Q/800+110x(V^^1/2)	
Oil	309.75 W/L and 7.6 L max.	14.7 kW min. and 61.552 kW max.	10 CFR 430	ET = 80 percent and EF = 0.59-0.005V	
Oil	309.75 W/L and 37.85 L max.	61.552 kW max.	ANSI Z21.10.3,	ET = 80 percent	
Oil	309.75 W/L and 37.85 L min.	61.552 kW max.	ANSI Z21.10.3,	ET = 78 percent and SL = (Q800+110x(V^^1/2))	
D. Pool Heater					
Gas or Oil	All	All	ASHRAE 146	ET = 82 percent	
Heat Pump All	All	All	ANSI/AHRI 116	COP = 4.0	

TABLE III

STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

FUEL	STORAGE CAPACITY LITERS	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE

TERMS:

DP = Draw Pattern
EF = Energy factor, minimum overall efficiency.
ET = Minimum thermal efficiency with 21 degrees C delta T.
SL = Standby loss is maximum Watts based on a 21 degrees C temperature difference between stored water and ambient requirements.
UEF = Uniform energy factor
V = Rated storage volume in gallons
Q = Nameplate input rate in Watts

TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY OR RATING CONDITION	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
A. STORAGE WATER HEATERS					
Elect.	≥20 gal and ≤55 gal		10 CFR 430	DP	UEF
				Very Small	0.8808 - (0.0008 x V)
				Low	0.9254 - (0.0003 x V)
				Medium	0.9307 - (0.0002 x V)
				High	0.9349 - (0.0001 x V)
Elect.	>55 gal and ≤120 gal		10 CFR 430	DP	UEF
				Very Small	1.9236 - (0.0011 x V)
				Low	2.0440 - (0.0011 x V)
				Medium	2.1171 - (0.0011 x V)
				High	2.2418 - (0.0011 x V)
Elect. Heat Pump		≤24 Amps and ≤250 Volts	10 CFR 430	Rating Condition	UEF
				Integrated heat pump water heater (HPWH)	UEF ≥3.3 and First Hour Rating ≥45 gal/h
				Integrated HPWH, >120 V/15 Amp Circuit or Split-System HPWH	UEF ≥2.2 and First Hour Rating ≥45 gal/h
Elect. Heat Pump		>12 kW	10 CFR 430	HPWH COP ≥3.0	

TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY OR RATING CONDITION	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
Gas	≥20 gal and ≤55 gal		10 CFR 430	DP	UEF
				Very Small	0.3456 - (0.0020 x V)
				Low	0.5982 - (0.0019 x V)
				Medium	0.6483 - (0.0017 x V)
				High	0.6920 - (0.0013 x V)
Gas	>55 gal and ≤100 gal		10 CFR 430	DP	UEF
				Very Small	0.6470 -
				Low	0.7689 -
				Medium	0.7897 - (0.0004 x V)
				High	0.8072 - (0.0003 x V)
Gas	≤120 gal	75,000 Btu/h	10 CFR 430	DP	UEF
				Very Small	0.2674 - (0.0009 x V)
				Low	0.5362 - (0.0012 x V)
				Medium	0.6002 - (0.0011 x V)
				High	0.6597 - (0.0009 x V)
Oil	≤50 gal		10 CFR 430	DP	UEF
				Very Small	0.2509 - (0.0012 x V)
				Low	0.5330 -
				Medium	0.6078 - (0.0016 x V)
				High	0.6815 - (0.0014 x V)

TABLE III					
STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT					
FUEL	STORAGE CAPACITY OR RATING CONDITION	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE	
Oil	<120 gal	>105,000 Btu/h and ≤ 140,000 Btu/h	10 CFR 430	DP	UEF
				Very Small	0.2932 - (0.0015 x V)
				Low	0.5596 - (0.0018 x V)
				Medium	0.6194 - (0.0016 x V)
				High	0.6740 - (0.0013 x V)
B. Unfired Hot Water Storage, R-12.5 min.					
C. Instantaneous Water Heater					
Elect.	<2 gal		10 CFR 430	DP	UEF
				Very Small	0.91
				Low	0.91
				Medium	0.91
				High	0.92
Gas	<2 gal and >50,000 Btu/h		10 CFR 430	DP	UEF
				Very Small	0.80
				Low	0.81
				Medium	0.81
				High	0.81
Gas	4,000 (btu/h)/gal and 10 gal max.	200,000 Btu/h min.	ANSI Z21.10.3/C	ET = 80 percent	
Gas	4,000 (btu/h)/gal and 10 gal max.	200,000 Btu/h min.	ANSI Z21.10.3/C	ET = 80 percent SL = (Q/800+110x(V^^1/2))	
Oil	4,000 (btu/h)/gal and 2 gal max.	50,000 Btu/h min. 210,000 Btu/h max.	10 CFR 430	ET = 80 percent and EF = 0.59-0.0005V	

TABLE III

STANDARD RATING CONDITIONS AND MINIMUM PERFORMANCE RATINGS FOR WATER HEATING EQUIPMENT

FUEL	STORAGE CAPACITY OR RATING CONDITION	INPUT RATING	TEST PROCEDURE	REQUIRED PERFORMANCE
Oil	4,000 (btu/h)/gal and 10 gal max.	210,000 Btu/h min.	ANSI Z21.10.3/C	ET = 80 percent
Oil	4,000 (btu/h)/gal and 10 gal max.	210,000 Btu/h min.	ANSI Z21.10.3/C	ET = 78 percent SL = (Q/800+110x(V^^1/2)) max.
D. Pool Heater				
Gas or Oil	All	All	ASHRAE 146	ET = 82 percent
Heat Pump All	All	All	ANSI/AHRI 1160	COP = 4.0

TERMS:

DP = Draw Pattern
EF = Energy factor, minimum overall efficiency.
ET = Minimum thermal efficiency with 70 degrees F delta T.
SL = Standby loss is maximum Btu/h based on a 70 degree F temperature difference between stored water and ambient requirements.
UEF = Uniform energy factor
V = Rated storage volume in gallons
Q = Nameplate input rate in Btu/h

-- End of Section --