

VAMC COATESVILLE, PA  
INSTALL BACKFLOW PREVENTER SOUTH PUMP BLDG 25  
PROJECT NUMBER: 542-15-121

SECTION 22 00 00

PLUMBING, GENERAL PURPOSE  
**11/11**

PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1013	(2011) Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers - (ANSI approved 2010)
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AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA 10084	(2005) Standard Methods for the Examination of Water and Wastewater
AWWA B300	(2010; Addenda 2011) Hypochlorites
AWWA B301	(2010) Liquid Chlorine
AWWA C509	(2009) Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	(2009) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2010) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains

ASME INTERNATIONAL (ASME)

ASME B16.34	(2013) Valves - Flanged, Threaded and Welding End
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ASTM INTERNATIONAL (ASTM)

ASTM A536	(1984; R 2009) Standard Specification for Ductile Iron Castings
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INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS  
(IAPMO)

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IAPMO UPC	(2003) Uniform Plumbing Code
INTERNATIONAL CODE COUNCIL (ICC)	
ICC IPC	(2012) International Plumbing Code
MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)	
MSS SP-110	(2010) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends
MSS SP-25	(2013) Standard Marking System for Valves, Fittings, Flanges and Unions
MSS SP-58	(2009) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-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-136	(2014) Ductile Iron Swing Check Valves
NACE INTERNATIONAL (NACE)	
NACE SP0169	(2013) Control of External Corrosion on Underground or Submerged Metallic Piping Systems
NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)	
NEMA 250	(2008) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA MG 1	(2011; Errata 2012) Motors and Generators
NEMA MG 11	(1977; R 2012) Energy Management Guide for Selection and Use of Single Phase Motors
SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)	
SAE J1508	(2009) Hose Clamp Specifications

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted:

SD-03 Product Data

Backflow prevention assemblies; G  
Backflow enclosure

SD-06 Test Reports

Tests, Flushing and Disinfection

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

Test of Backflow Prevention Assemblies; G

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

SD-10 Operation and Maintenance Data

Backflow Prevention Assemblies Operation and Maintenance Data

SD-11 Close Outs

Two (2) sets of keys to backflow enclosure

1.3 STANDARD PRODUCTS

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

1.3.1 Alternative Qualifications

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

### 1.3.2 Service Support

The equipment items shall be supported by service organizations. Submit a certified list of qualified permanent service organizations for support of the equipment which includes their addresses and qualifications. These service organizations shall be reasonably convenient to the equipment installation and able to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

### 1.3.3 Manufacturer's Nameplate

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

### 1.3.4 Modification of References

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

#### 1.3.4.1 Definitions

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

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

### 1.4 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.

### 1.5 REGULATORY REQUIREMENTS

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Unless otherwise required herein, plumbing work shall be in accordance with ICC IPC. Energy consuming products and systems shall be in accordance with PL 109-58 and ASHRAE 90.1 - SI (ASHRAE 90.1 - IP)

#### 1.6 PROJECT/SITE CONDITIONS

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

#### 1.7 INSTRUCTION TO GOVERNMENT PERSONNEL

When specified in other sections, 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 shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance work.

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

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.

#### 1.8 ACCESSIBILITY OF EQUIPMENT

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

Materials for various services shall be in accordance with TABLES I and II. Pipe schedules shall be selected based on service requirements. Pipe fittings shall be compatible with the applicable pipe materials. Iron Pipe size and shall comply with NSF/ANSI 14, NSF/ANSI 61 and ASTM F2389. Grooved pipe couplings and fittings shall be from the same manufacturer. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61, Annex G or NSF 372. In line devices such as water meters, building valves, check valves, meter stops, valves, fittings and back flow preventers shall comply with PL 93-523 and NSF/ANSI 61, Section 8. Hubless cast-iron soil pipe shall not be installed underground, under concrete floor slabs, or in crawl spaces below kitchen floors.

#### 2.1.1 Pipe Joint Materials

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

- a. Coupling for Cast-Iron Pipe: for hub and spigot type ASTM A74, AWWA C606. For hubless type: CISPI 310
- b. Couplings for Grooved Pipe: Ductile Iron ASTM A536 (Grade 65-45-12).
- c. Flange Gaskets: Gaskets shall be made of non-asbestos material in accordance with ASME B16.21. Gaskets shall be flat, 1.6 mm (1/16 inch) thick, and contain Aramid fibers bonded with Styrene Butadiene Rubber (SBR) or Nitro Butadiene Rubber (NBR). Gaskets shall be the full face or self centering flat ring type. Gaskets used for hydrocarbon service shall be bonded with NBR.
- d. Rubber Gaskets for Grooved Pipe: ASTM D2000, maximum temperature 110 degrees C (230 degrees F).
- e. Bolts and Nuts for Grooved Pipe Couplings: Heat-treated carbon steel, ASTM A183.
- f. Flanged fittings including flanges, bolts, nuts, bolt patterns, etc., shall be in accordance with ASME B16.5 class 150 and shall have the manufacturer's trademark affixed in accordance with MSS SP-25. Flange material shall conform to ASTM A105/A105M. Blind flange material shall conform to ASTM A516/A516M cold service and ASTM A515/A515M for hot service. Bolts shall be high strength or intermediate strength with material conforming to ASTM A193/A193M.

#### 2.1.2 Miscellaneous Materials

Miscellaneous materials shall conform to the following:

- a. Hose Clamps: SAE J1508.
- b. Hypochlorites: AWWA B300.
- c. Liquid Chlorine: AWWA B301.
- d. Gauges - Pressure and Vacuum Indicating Dial Type - Elastic Element: ASME B40.100.

#### 2.2 PIPE HANGERS, INSERTS, AND SUPPORTS

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

## 2.3 VALVES

Valves shall be provided on supplies to equipment and fixtures. Valves 80 mm (3 inches) and larger shall have flanged iron bodies and bronze trim. Pressure ratings shall be based upon the application. Grooved end valves may be provided if the manufacturer certifies that the valves meet the performance requirements of applicable MSS standard. Valves shall conform to the following standards:

Table I - Valve 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
Ductile Iron Swing Check Valves	MSS SP-136
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

## 2.4 BACKFLOW PREVENTERS

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.

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Reduced pressure principle assemblies shall meet the above requirements and shall conform to ASSE 1013, NSF/ANSI 372 and be supplied with full port gate valves.

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

#### 2.4.1 Materials

Main valve body and access covers shall be ductile iron, ASTM A536 Grade 4. Coatings shall be fusion epoxy finish. Internal components, fasteners, springs and sensing line shall be stainless steel. Stem shall be stainless steel, ASTM A276. Seals shall be EPDM.

End connections shall be flanged, ANSI B16.1, Class 125.

#### 2.4.2 Valves

Reduced pressure principle assembly shall have OS&Y gate valves.

#### 2.4.3 Manufacturer

Approved Manufacturers: Zurn Wilkins (RPPA model 375OSY), Watts (RPPA model LF909), or approved equal.

### 2.5 BACKFLOW ENCLOSURE

Backflow enclosure shall be insulated and completely removable and lockable, with access panel doors and built-in heater. Enclosure shall be certified ASSE 1060. Enclosure shall be designed to support a minimum vertical load of 100psf and withstand wind gusts up to 140mph.

#### 2.5.1 Enclosure Box

Enclosure skin shall be of minimum 18 gauge reinforced aluminum sheeting meeting ASTM B209, with bracing of 6063-T52 aluminum meeting ASTM B221. No wood or particle board shall be used in the construction of the enclosure box.

Four (4) drains shall be provided, sized for full port backflow discharge and designed for one-way exit, inhibiting intrusion of debris and/or vermin.

Enclosure shall be anchored to concrete pad from within the enclosure with steel anchors. Anchor pads shall be galvanized steel.

Color to be Federal Brown.

#### 2.5.2 Insulation

Insulation shall be minimum 1-1/2" thick unicellular, non-wicking insulation and shall form a monolithic bond with metal frame and skin.

The following values shall be met:



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R-Value	10
Compressive strength	51 psi
Flame point	325°F
Water absorption	0.037 psf
Porosity	91%

### 2.5.3 Keys

Contractor shall provide two (2) keys to Contracting Officer Representative upon substantial completion. Each key shall be capable of opening all panel door locks.

### 2.5.4 Manufacturer

Approved Manufacturers: HotBox Enclosures (model HA067090058), WattsBox Insulated Enclosures (model WB-N10), or approved equal.

## 2.6 ELECTRICAL WORK

### 2.6.1 NEMA Heater

Backflow enclosure shall be provided with two (2) heaters to protect equipment from exterior temperatures to -30°F and be thermostatically controlled. UL or ETL listed self-regulating cable or wall mounted air heater(s) will be sized to maintain the equipment at +40°F, in accordance with NFPA 3-3.1.8 and 3-6.1.3.2. Heat source shall be mounted a minimum of 7" above the slab unless it is UL or ETL certified and NEC approved for submersion. Power sources shall be protected with a ground fault interrupting receptacle, UL 943, NEMA 3R, inside the enclosure. Provide separate 20 amp circuits for each heater.

## 2.7 MISCELLANEOUS PIPING ITEMS

### 2.7.1 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors as indicated on drawings. Pipe sleeves shall be 1/4-inch thick steel as indicated on drawings.

### 2.7.2 Casing Spacers

Provide where piping passes entirely through walls, ceilings, roofs, and floors as indicated on drawings. Inside diameter of casing spacers shall be 6" as indicated on drawings. Casing spacers shall be T-304 stainless steel of minimum 14 gauge thickness lined with ribbed PVC extrusion with a retaining section that overlaps the edges of the shell and prevents slippage. Bearing surfaces (runners) shall be ultra-high molecular weight polyethylene (UHMW) to provide abrasion resistance and a low coefficient of friction (0.12). Support structure (risers) shall be made of T-304 stainless steel of 10 gauge, welded to the shell. Provide casing spacers with centered configuration as indicated on drawings.

Approved Manufacturers: Cascade Waterworks (style CCS), BWM Company (KP and KC Polymer style), or approved equal.

### 2.7.3 Pipe Supports

Provide adjustable type steel base stand, except as specified or indicated otherwise. Attach to adjustable stand with Type 36 pipe saddle support, Type 37 pipe saddle support with heavy duty yoke U-bolt. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

Approved Manufacturers: Eaton B-Line Series (models B3088T and B3093),  
Piping Technology and Products, Inc. (Figure 43),  
or approved equal.

### 2.7.4 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 shall 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.

## PART 3 EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

Piping shall be connected to the exterior service lines or capped or plugged if the exterior service is not in place. Sewer and water pipes shall be laid in separate trenches, except when otherwise shown. Exterior underground utilities shall be at least 300 mm (12 inches) below the 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 shall be marked with a stake or other acceptable means. Valves shall be installed with control no lower than the valve body.

#### 3.1.1 Water Pipe, Fittings, and Connections

##### 3.1.1.1 Cutting and Repairing

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

##### 3.1.1.2 Protection of Fixtures, Materials, and Equipment

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

and operated. Safety guards shall be provided for exposed rotating equipment.

#### 3.1.1.3 Mains, Branches, and Runouts

Piping shall be installed as indicated. Pipe shall be accurately cut and worked into place without springing or forcing. Structural portions of the building shall not be weakened. Aboveground piping shall run parallel with the lines of the building, unless otherwise indicated. Bare and insulated water lines shall not bear directly against building structural elements so as to transmit sound to the structure or to prevent flexible movement of the lines. Water pipe shall not be buried in or under floors unless specifically indicated or approved. Changes in pipe sizes shall be made with reducing fittings. Use of bushings will not be permitted except for use in situations in which standard factory fabricated components are furnished to accommodate specific accepted installation practice. Change in direction shall be made with fittings.

#### 3.1.1.4 Expansion and Contraction of Piping

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

#### 3.1.1.5 Thrust Restraint

Plugs, caps, tees, valves and bends deflecting 11.25 degrees or more, either vertically or horizontally, in underground waterlines 100 mm (4 inches) in diameter or larger shall be provided with thrust blocks, where indicated, to prevent movement. Thrust blocking shall 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 shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of the thrust block shall be poured against undisturbed earth. The side of the thrust block not subject to thrust shall be poured against forms. The area of bearing will be as shown. Blocking shall be placed so that the joints of the fitting are accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

#### 3.1.2 Joints

Installation of pipe and fittings shall be made in accordance with the manufacturer's recommendations. Mitering of joints for elbows and notching

of straight runs of pipe for tees will not be permitted. Joints shall be made up with fittings of compatible material and made for the specific purpose intended.

#### 3.1.2.1 Unions and Flanges

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

#### 3.1.2.2 Grooved Mechanical Joints

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

#### 3.1.2.3 Other Joint Methods

#### 3.1.3 Dissimilar Pipe Materials

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

#### 3.1.4 Corrosion Protection for Buried Pipe and Fittings

Ductile iron, cast iron, and steel pipe, fittings, and joints shall have a protective coating. Additionally, ductile iron, cast iron, and steel pressure pipe shall have a cathodic protection system and joint bonding. The cathodic protection system, protective coating system, and joint bonding for cathodically protected pipe shall be selected, applied, and inspected in accordance with NACE SP0169 and as otherwise specified. The pipe shall be cleaned and the coating system applied prior to pipe tightness testing. Joints and fittings shall be cleaned and the coating system applied after pipe tightness testing. For tape coating systems, the tape shall conform to AWWA C203 and shall be applied with a 50 percent overlap. Primer utilized with tape type coating systems shall be as recommended by the tape manufacturer.

### 3.1.5 Pipe Sleeves and Flashing

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

#### 3.1.5.1 Sleeve and Casing Spacer Requirements

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

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

A casing spacer shall be installed in the annular space between pipe and sleeve. Each seal assembly shall be sized as recommended by the manufacturer to fit the pipe and sleeve involved. Fill annular space between steel sleeve and casing spacer with 2-Hour rated fire insulating foam.

Except as otherwise specified, the annular space between wall and sleeve shall be sealed as indicated with structural non-shrink grout.

### 3.1.6 Supports

#### 3.1.6.1 General

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

Structural steel required for reinforcement to properly support piping, headers, and equipment, but not shown, shall be provided.

#### 3.1.6.2 Pipe Hangers, Inserts, and Supports

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

- a. Types 5, 12, and 26 shall not be used.
- b. Type 3 shall not be used on insulated pipe.
- c. Type 18 inserts shall be secured to concrete forms before concrete is placed. Continuous inserts which allow more adjustment may be used if they otherwise meet the requirements for type 18 inserts.

- d. Type 19 and 23 C-clamps shall be torqued per MSS SP-58 and shall 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 shall 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 shall be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or higher. Type 39 saddles shall be welded to the pipe.
- h. Type 40 shields shall:
  - (1) Be used on insulated pipe less than 100 mm (4 inches).
  - (2) Be used on insulated pipe 100 mm (4 inches) and larger when the temperature of the medium is 15 degrees C (60 degrees F) or less.
  - (3) Have a high density insert for all pipe sizes. High density inserts shall have a density of 128 kg per cubic meter (8 pcf) or greater.
- i. Horizontal pipe supports shall be spaced as specified in MSS SP-58 and a support shall be installed not over 300 mm (1 foot) from the pipe fitting joint at each change in direction of the piping. Pipe supports shall be spaced not over 1.5 m (5 feet) apart at valves. Operating temperatures in determining hanger spacing for PVC or CPVC pipe shall be 49 degrees C (120 degrees F) for PVC and 82 degrees C (180 degrees F) for CPVC. Horizontal pipe runs shall include allowances for expansion and contraction.
- j. Vertical pipe shall be supported at each floor, except at slab-on-grade, at intervals of not more than 4.5 m (15 feet) nor more than 2 m (8 feet) from end of risers, and at vent terminations. Vertical pipe risers shall include allowances for expansion and contraction.
- k. Type 35 guides using steel, reinforced polytetrafluoroethylene (PTFE) or graphite slides shall be provided to allow longitudinal pipe movement. Slide materials shall be suitable for the system operating temperatures, atmospheric conditions, and bearing loads encountered. Lateral restraints shall be provided as needed. Where steel slides do not require provisions for lateral restraint the following may be used:
  - (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 than 15 degrees C (60 degrees F) a Type 40 shield, attached to the pipe or insulation, may freely rest on a steel plate.

#### 3.1.6.3 Structural Attachments

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

### 3.2 FIXTURES AND FIXTURE TRIMMINGS

#### 3.2.1 Backflow Prevention Devices

Plumbing fixtures, equipment, and pipe connections shall not cross connect or interconnect between a potable water supply and any source of nonpotable water. Backflow preventers shall be installed where indicated and in accordance with [ICC IPC] [IAPMO UPC] at all other locations necessary to preclude a cross-connect or interconnect between a potable water supply and any nonpotable substance. In addition backflow preventers shall be installed at all locations where the potable water outlet is below the flood level of the equipment, or where the potable water outlet will be located below the level of the nonpotable substance. Backflow preventers shall be located so that no part of the device will be submerged. Backflow preventers shall be of sufficient size to allow unrestricted flow of water to the equipment, and preclude the backflow of any nonpotable substance into the potable water system. Bypass piping shall not be provided around backflow preventers. Access shall be provided for maintenance and testing. Each device shall be a standard commercial unit.

### 3.3 IDENTIFICATION SYSTEMS

#### 3.3.1 Identification Tags

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

### 3.4 TESTS, FLUSHING AND DISINFECTION

#### 3.4.1 Plumbing System

The following tests shall be performed on the plumbing system in accordance with IAPMO UPC.

#### 3.4.1.1 Test of Backflow Prevention Assemblies

Backflow prevention assembly shall be tested using gauges specifically designed for the testing of backflow prevention assemblies.

Backflow prevention assembly test gauges shall 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 shall 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 shall include, as a minimum, the following:

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

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

#### 3.4.2 Defective Work

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

#### 3.4.3 System Flushing

##### 3.4.3.1 During Flushing

Before operational tests or disinfection, potable water piping system shall be flushed with [hot] potable water. Sufficient water shall be used to produce a water velocity that is capable of entraining and removing debris in all portions of the piping system. This requires simultaneous operation of all fixtures on a common branch or main in order to produce a flushing velocity of approximately 1.2 meters per second (4 fps) through all portions of the piping system. In the event that this is impossible due to size of system, the Contracting Officer (or the designated representative) shall



specify the number of fixtures to be operated during flushing. Contractor shall 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 shall be responsible for any flood damage resulting from flushing of the system. Flushing shall be continued until entrained dirt and other foreign materials have been removed and until discharge water shows no discoloration. All faucets and drinking water fountains, to include any device considered as an end point device by NSF/ANSI 61, Section 9, shall be flushed a minimum of 1 L (0.25 gallons) per 24 hour period, ten times over a 14 day period.

#### 3.4.3.2 After Flushing

System shall be drained at low points. Strainer screens shall be removed, cleaned, and replaced. After flushing and cleaning, systems shall be prepared for testing by immediately filling water piping with clean, fresh potable water. Any stoppage, discoloration, or other damage to the finish, furnishings, or parts of the building due to the Contractor's failure to properly clean the piping system shall be repaired by the Contractor. When the system flushing is complete, the hot-water system shall be adjusted for uniform circulation. Flushing devices and automatic control systems shall be adjusted for proper operation according to manufacturer's instructions. Comply with ASHRAE 90.1 - SI (ASHRAE 90.1 - IP) for minimum efficiency requirements. Unless more stringent local requirements exist, lead levels shall not exceed limits established by 40 CFR 141.80 (c) (1). The water supply to the building shall be tested separately to ensure that any lead contamination found during potable water system testing is due to work being performed inside the building.

#### 3.4.4 Operational Test

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

- a. Time, date, and duration of test.
- b. Water pressures at the most remote and the highest fixtures.
- c. Operation of each fixture and fixture trim.
- d. Operation of each valve, hydrant, and faucet.
- e. Pump suction and discharge pressures.
- f. Temperature of each domestic hot-water supply.
- g. Operation of each floor and roof drain by flooding with water.
- h. Operation of each vacuum breaker and backflow preventer.

- i. Complete operation of each water pressure booster system, including pump start pressure and stop pressure.
- j. Compressed air readings at each compressor and at each outlet. Each indicating instrument shall be read at 1/2 hour intervals. The report of the test shall be submitted in quadruplicate. The Contractor shall furnish instruments, equipment, and personnel required for the tests; the Government will furnish the necessary water and electricity.

#### 3.4.5 Disinfection

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

Water chlorination procedure shall be in accordance with AWWA C651 and AWWA C652 as modified and supplemented by this specification. The chlorinating material shall be hypochlorites or liquid chlorine. The chlorinating material shall be fed into the water piping system at a constant rate at a concentration of at least 50 parts per million (ppm). 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.

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 shall 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.

Upon the specified verification, the system including tanks shall 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 shall be opened and closed several times.

Take addition 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 shall be EPA approved for drinking water systems and shall comply with applicable local and state requirements.

Disinfection shall 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.

### 3.5 WASTE MANAGEMENT

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

### 3.6 PIPE AND FITTING MATERIALS

Table II - Pipe and Fittings Standards

<b>SERVICE:</b>					
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					
* - Hard Temper					

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. Galvanized, ASME B16.3 for use with Item 4a	X	X	X	X
	b. Same as "a" but 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, galvanized, ASTM A53/A53M, Type S, Grade B	X	X	X	X
	b. 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
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
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

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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
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

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38	<p>Press Fittings:</p> <ul style="list-style-type: none"><li>A - Cold Water Service Aboveground</li><li>B - Hot and Cold Water Distribution 82 degrees C 180 degrees F Maximum Aboveground</li><li>C - Compressed Air Lubricated</li><li>D - Cold Water Service Belowground</li></ul> <p>Indicated types are minimum wall thicknesses.</p> <ul style="list-style-type: none"><li>** - Type L - Hard</li><li>*** - Type K - Hard temper with brazed joints only or type K-soft temper without joints in or under floors</li><li>**** - In or under slab floors only brazed joints</li></ul>
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