

SECTION 33 11 00

WATER DISTRIBUTION
March 3, 2014

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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION
OFFICIALS (AASHTO)

AASHTO HB-17 (2002; Errata 2003; Errata 2005) Standard Specifications for
Highway Bridges

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY
ASSOCIATION (AREMA)

AREMA Eng Man (2007) Manual for Railway Engineering

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300 (2004) Hypochlorites

AWWA B301 (2004) Liquid Chlorine

AWWA C104/A21.4 (2003) Cement-Mortar Lining for Ductile-Iron Pipe and
Fittings for Water

AWWA C105/A21.5 (2005) Polyethylene Encasement for Ductile-Iron Pipe
Systems

AWWA C110/A21.10 (2003) Ductile-Iron and Gray-Iron Fittings for Water

AWWA C111/A21.11 (2000) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe
and Fittings

AWWA C115/A21.15 (2005) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-
Iron Threaded Flanges

AWWA C151/A21.51 (2002; Errata 2002) Ductile-Iron Pipe, Centrifugally Cast, for
Water

AWWA C153/A21.53 (2006) Ductile-Iron Compact Fittings for Water Service

AWWA C200 (2005) Steel Water Pipe - 6 In. (150 mm) and Larger

AWWA C203	(2002) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied
AWWA C205	(2000) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied
AWWA C206	(2003) Field Welding of Steel Water Pipe
AWWA C207	(2007) Standard for Steel Pipe Flanges for Waterworks Service-Sizes 100 mm through 3600 mm 4 in. through 144 in.
AWWA C208	(2001; R 2002) Standard for Dimensions for Fabricated Steel Water Pipe Fittings
AWWA C209	(2006) Cold-Applied Tape Coatings for the Exterior of Special Sections, Connections and Fitting for Steel Water Pipe
AWWA C210	(2003; R 2004) Standard for Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
AWWA C300	(2004) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type
AWWA C301	(2007) Prestressed Concrete Pressure Pipe, Steel-Cylinder Type
AWWA C303	(2002) Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type
AWWA C500	(2002; R 2003) Metal-Seated Gate Valves for Water Supply Service
AWWA C502	(2005) Dry-Barrel Fire Hydrants
AWWA C503	(2005) Wet-Barrel Fire Hydrants
AWWA C504	(2006) Standard for Rubber-Seated Butterfly Valves
AWWA C508	(2001) Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS
AWWA C509	(2001) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2005) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C605	(2005) Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

AWWA C606	(2006) Grooved and Shouldered Joints
AWWA C651	(2005; Errata 2005) Standard for Disinfecting Water Mains
AWWA C700	(2002; R 2003) Standard for Cold Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(2007) Standard for Cold-Water Meters - Turbine Type for Customer Service
AWWA C702	(2001) Cold-Water Meters - Compound Type
AWWA C703	(1996; R 2004) Cold-Water Meters - Fire Service Type
AWWA C704	(2002) Propeller-Type Meters for Waterworks Applications
AWWA C706	(1996; R 2005) Direct-Reading, Remote-Registration Systems for Cold-Water Meters
AWWA C707	(2005) Encoder-Type Remote-Registration Systems for Cold-Water Meters
AWWA C800	(2005) Underground Service Line Valves and Fittings
AWWA C900	(2007) Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Distribution
AWWA C901	(2002) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13mm) Through 3 In. (76 mm), for Water Service
AWWA C905	(1997) Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14 In. Through 48 In. (350 mm through 1,200 mm)
AWWA C906	(2007) Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) through 63 In., (1,575 mm) for Water Distribution and Transmission
AWWA C909	(2002) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 IN through 12 IN (100 mm Through 300 mm), for Water Distribution
AWWA C950	(2007) Fiberglass Pressure Pipe
AWWA M11	(2004) Manual: Steel Pipe: A Guide for Design and Installation
AWWA M23	(2002) Manual: PVC Pipe - Design and Installation

AWWA M9 (1995) Manual: Concrete Pressure Pipe

ASME INTERNATIONAL (ASME)

ASME B16.1 (2005) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B16.15 (2006) Cast Bronze Threaded Fittings Classes 125 and 250

ASME B16.18 (2001; R 2005) Cast Copper Alloy Solder Joint Pressure Fittings

ASME B16.22 (2001; R 2005) Standard for Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

ASME B16.26 (2006) Standard for Cast Copper Alloy Fittings for Flared Copper Tubes

ASME B16.3 (2006) Malleable Iron Threaded Fittings, Classes 150 and 300

ASME B16.4 (2006) Standard for Gray Iron Threaded Fittings; Classes 125 and 250

ASME B18.2.2 (1987; R 2005) Standard for Square and Hex Nuts (Inch Series)

ASME B18.5.2.1M (2006) Metric Round Head Short Square Neck Bolts

ASME B18.5.2.2M (1982; R 2005) Metric Round Head Square Neck Bolts

ASTM INTERNATIONAL (ASTM)

ASTM A 307 (2007a) Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

ASTM A 47/A 47M (1999; R 2004) Standard Specification for Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 48/A 48M (2003) Standard Specification for Gray Iron Castings

ASTM A 53/A 53M (2007) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM A 536 (1984; R 2004) Standard Specification for Ductile Iron Castings

ASTM A 563 (2007) Standard Specification for Carbon and Alloy Steel Nuts

ASTM A 563M (2006) Standard Specification for Carbon and Alloy Steel Nuts (Metric)

ASTM A 746	(2003) Standard Specification for Ductile Iron Gravity Sewer Pipe
ASTM B 32	(2004) Standard Specification for Solder Metal
ASTM B 42	(2002e1) Standard Specification for Seamless Copper Pipe, Standard Sizes
ASTM B 61	(2002) Standard Specification for Steam or Valve Bronze Castings
ASTM B 62	(2002) Standard Specification for Composition Bronze or Ounce Metal Castings
ASTM B 88	(2003) Standard Specification for Seamless Copper Water Tube
ASTM B 88M	(2005) Standard Specification for Seamless Copper Water Tube (Metric)
ASTM C 150	(2007) Standard Specification for Portland Cement
ASTM C 94/C 94M	(2007) Standard Specification for Ready-Mixed Concrete
ASTM D 1527	(1999; R 2005) Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
ASTM D 1599	(2005) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D 1784	(2006a) Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC), Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2235	(2004) Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
ASTM D 2241	(2005) Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2282	(1999; R 2005) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)
ASTM D 2464	(2006) Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2466	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(2006) Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2468	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
ASTM D 2564	(2004e1) Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(2007) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2774	(2004e1) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996; R 2002) Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(2001; R 2007e1) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(2001; R 2007e1) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3139	(1998; R 2005) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3839	(2002e1) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 4161	(2001; R 2005) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals
ASTM F 1483	(2005) Oriented Poly(Vinyl Chloride), PVCO, Pressure Pipe
ASTM F 402	(2005) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 477	(2007) Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

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

MSS SP-80	(2003) Bronze Gate, Globe, Angle and Check Valves
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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 1961	(2007) Standard on Fire Hose
NFPA 24	(2006) Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 325	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 49	(2003) Hazardous Chemicals Data
NFPA 704	(2006) Identification of the Hazards of Materials for Emergency Response

UNDERWRITERS LABORATORIES (UL)

UL 246	(1993; Rev thru Dec 1998) Hydrants for Fire-Protection Service
UL 262	(2004) Standard for Gate Valves for Fire-Protection Service
UL 312	(2004) Check Valves for Fire-Protection Service
UL 789	(2004) Indicator Posts for Fire-Protection Service

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-3	(1992) Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Pressure Pipe (Nominal Diameters 4-36 Inch)
UBPPA UNI-B-8	(2000) Recommended Practice for the Direct Tapping of Polyvinyl Chloride (PVC) Pressure Water Pipe (Nominal Diameters 6-12 Inch)

CALIFORNIA CODE OF REGULATIONS (CCR)

CCR Title 22	Safe Drinking Water Act
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1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for contractor approval and submitted to the Project Manager for information only. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD 02 Drawings

Shop drawings
As-built drawings

SD 03 Product Data

Piping Materials

Water distribution main piping, fittings, joints, valves, and coupling

Water service line piping, fittings, joints, valves, and coupling

Hydrants

Indicator posts

Corporation stops

Valve boxes

Joint restraints materials and methods

For the above submit manufacturer's standard drawings or catalog cuts. Include information concerning gaskets with submittal for joints and couplings.

SD 05 Test Plan; G

Connection and Test Plan

SD 06 Test Reports; G

Bacteriological Disinfection

Test results from commercial, California Dept. of Health certified laboratory verifying disinfection.

Reports of pressure tests

SD 08 Manufacturer's Instructions

Installation procedures for water piping

1.4 DRAWINGS

1.4.1 Shop Drawings

The Contractor shall submit shop drawings for new water main installation consisting of end to end layout drawings of main with offset dimensions to existing site features; and connection points to existing mains and water services. Shop drawings shall indicate necessary offsets to existing utilities such that crossing points are coordinated. Shop drawings shall be coordinated with shop drawings

required by other specification sections. Shop drawings shall be submitted 30 days in advance of start of work.

1.4.2 As-Built Drawings

The as-built drawings shall be a record of the construction as installed. The drawings shall include the information shown on the contract drawings as well as deviations, modifications, and changes from the contract drawings, however minor. The as-built drawings shall be a full sized set of prints marked to reflect deviations, modifications, and changes. Additional sheets may be added. The as-built drawings shall be jointly inspected for accuracy and completeness by the Contractor and by the Contracting Officer prior to the submission of each monthly pay estimate. Upon completion of the work, the Contractor shall provide three full sized sets of the marked prints to the Contracting Officer for approval. If upon review, the as-built drawings are found to contain errors and/or omissions, they will be returned to the Contractor for correction. The Contractor shall correct and return the as-built drawings to the Contracting Officer for approval within 10 calendar days from the time the drawings are returned to the Contractor.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery and Storage

Inspect materials delivered to site for damage. Unload and store with minimum handling. Store materials on site in enclosures or under protective covering. Store rubber gaskets under cover out of direct sunlight. Do not store materials directly on the ground. Keep inside of pipes, fittings, valves and hydrants free of dirt and debris.

1.5.2 Handling

Handle pipe, fittings, valves, hydrants, and other accessories in a manner to ensure delivery to the trench in sound undamaged condition. Take special care to avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place any other material or pipe inside a pipe or fitting after the coating has been applied. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Store rubber gaskets that are not to be installed immediately, under cover out of direct sunlight.

1.5.2.3 Miscellaneous Plastic Pipe and Fittings

Handle Polyvinyl Chloride (PVC) pipe and fittings in accordance with the manufacturer's recommendations. Store plastic piping and jointing materials that are not to be installed immediately under cover out of direct sunlight.

Storage facilities shall be classified and marked in accordance with [NFPA 704](#), with classification as indicated in [NFPA 49](#) and [NFPA 325](#).

PART 2 PRODUCTS

2.1 WATER DISTRIBUTION MAIN MATERIALS

2.1.1 Piping Materials

2.1.1.1 Ductile-Iron Piping

a. Pipe and Fittings: Pipe, **AWWA C151/A21.51**. Flanged pipe, **AWWA C115/A21.15**. 3 inch through 12 inch Pressure Class 350, 14 inch and larger Pressure Class 250. Fittings, **AWWA C110/A21.10** or **AWWA C153/A21.53**. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fittings shall be suitable for the specified joints. Pipe and fittings shall have cement-mortar lining and interior asphaltic seal coat and exterior asphaltic coating, **AWWA C104/A21.4** standard thickness.

Manufacturer: US Pipe or approved equal.

2.1.1.3 Pipe Above Grade or in Below Ground Concrete Pits

- a. Same as paragraph 2.1.1.a, except that all fittings shall be flanged.
- b. Wall Sleeve Castings: Size and types **will be PVC C-900**. Seal strips, where required shall be Link Seal as manufactured by Thunderline Corp., Wayne, Michigan or equal.
- c. Rubber Ring Gaskets: Full face or **'drop-in'** type, AWWA C111, 2 mm (**1/8** inch) rubber ring gaskets.
- d. Pipe and fittings exposed to view in the finished work are to be painted. Pipe shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Kop-Coat No. 621 Rust Inhibitive Primer or equal. Paint color shall match the wall color.

2.1.1.4 Joints and Jointing Material in Ductile Iron and PVC Pipe

- a. Joints: Joints for pipe shall be bell and spigot or mechanical joint. Joints for fittings, valves, couplings and appurtenances shall be mechanical joint or flanged. Push on joint type fittings and valves shall not be used. Flanged joints shall only be installed above grade or below grade in a pit.
- b. Bell and spigot Joints (pipe-to-pipe only):
 - (1) Joints for ductile iron pipe, shape of pipe ends and fitting ends, gaskets, and lubricant for joint assembly, **AWWA C111/A21.11**.
 - (2) Joints for PVC pipe shall be bell and spigot joints, **ASTM D 3139**. Provide each joint connection with an elastomeric gasket suitable for the bell or coupling with which it is to be used.
- c. Mechanical Joints: Dimensional and material requirements for pipe ends, glands, bolts and nuts, and gaskets, **AWWA C111/A21.11**.
- d. Flanged Joints: Bolts and nuts, Grade B, domestically produced, ASTM A307, low alloy, high strength steel in accordance with AWWA C111. Gaskets for flanged connections as recommended in the Appendix to **AWWA C115/A21.15**. Flange for setscrewed flanges shall be of ductile iron,

ASTM A 536, Grade 65-45-12, and conform to the applicable requirements of ASME B16.1, Class 250. Setscrews for setscrewed flanges shall be 1310 MPa(190,000 psi) tensile strength, heat treated and zinc-coated steel. Gasket and lubricants for setscrewed flanges, in accordance with applicable requirements for mechanical-joint gaskets specified in AWWA C111/A21.11. Design of setscrewed gasket shall provide for confinement and compression of gasket when joint to adjoining flange is made. Assemble bolts and nuts using anti-seize compound to prevent galling.

Manufacturer: EBBA Iron 'E-Z' Flange or approved equal.

e. Insulating Joints (Where shown on drawings): Designed to effectively prevent metal-to-metal contact at the joint between adjacent sections of piping. Joint shall be of the flanged type with insulating gasket, insulating bolt sleeves, and insulating washers. Gasket shall be of the dielectric type, full face, and in other respects as recommended in the Appendix to AWWA C115/A21.15. Bolts and nuts, as recommended in the Appendix to AWWA C115/A21.15.

2.1.1.5 Joint Restraints

Joint restraints as manufactured by EBBA Iron, Inc. Megalug or approved equal for the type of joint and type of pipe material installed. Field lock type gaskets shall not be used. Installation in accordance with subparagraph 3.1.2 "Special Requirements for Installation of Water Mains".

2.1.2 Valves, Hydrants, and Other Water Main Accessories

2.1.2.1 Gate Valves on Buried Piping

AWWA C500, AWWA C509, or UL 262. Valves conforming to: (1) AWWA C500 shall be nonrising stem type with double-disc gates and mechanical-joint as appropriate for the adjoining pipe, (2) AWWA C509 shall be nonrising stem type with mechanical-joint ends, and (3) UL 262 shall be inside-screw type with operating nut, double-disc or split-wedge type gate, designed for a hydraulic working pressure of 175 psi, and shall have mechanical-joint ends as appropriate for the pipe to which it is joined. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Valves shall open by counterclockwise rotation of the valve stem. Stuffing boxes shall have O-ring stem seals. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550. Except for use with post indicators, furnish valves with 50 mm (2 inch) nut for socket wrench operation. Where a post indicator is shown, the valve shall have an indicator post flange; indicator post flange for AWWA C500 valve shall conform to the applicable requirements of UL 262. Valves shall be of one manufacturer.

Manufacturer: Clow or approved equal.

2.1.2.2 Gate Valves in Valve Pit(s) and Aboveground Locations

AWWA C500, AWWA C509, or UL 262. Valves conforming to: (1) AWWA C500 shall be hand wheel non-rising stem type with double-disc gates and flanged ends, (2) AWWA C509 shall be hand wheel non-rising stem type with flanged ends, and (3) UL 262 shall be hand wheel non-rising stem shall have double-disc type gate and flanged ends, and shall be designed for a hydraulic working pressure of 175 psi. Materials for UL 262 valves shall conform to the reference standards specified in AWWA C500. Provide valves with handwheels that open by counterclockwise rotation of the valve stem. Stuffing boxes shall be bolted and constructed so as to permit easy removal of parts for repair. Valves shall be of one manufacturer.

Manufacturer: Clow or approved equal.

2.1.2.3 Check Valves

Swing-check type, **AWWA C508** or **UL 312**. Valves conforming to: (1) **AWWA C508** shall have iron or steel body and cover and flanged ends, designed for a working pressure of 175 psi and (2) **UL 312** shall have cast iron or steel body and cover, flanged ends, and designed for a working pressure of 175 psi. Check valves for fire lines shall conform to AWWA C508 and shall be epoxy coated and lined per AWWA C550. Materials for **UL 312** valves shall conform to the reference standards specified in **AWWA C508**. Valves shall have clear port opening. Valves shall be spring-loaded where indicated. Valves shall be of one manufacturer.

2.1.2.5 Pressure Reducing Valves

Pressure reducing valves shall maintain a constant downstream pressure regardless of fluctuations in demand. The valves shall be of the hydraulically-operated, pilot controlled, globe or angle type, and may be actuated either by diaphragm or piston. The pilot control shall be the diaphragm-operated, adjustable, spring-loaded type, designed to permit flow when controlling pressure exceeds the spring setting. Ends shall be flanged. Valve bodies shall be bronze, cast iron or cast steel with bronze trim. Valve stem shall be stainless steel. Valve discs and diaphragms shall be synthetic rubber. Valve seats shall be bronze. Pilot controls shall be bronze with stainless steel working parts.

Manufacturer: Watts ACV 115 or approved equal.

2.1.2.6 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

2.1.2.7 Fire Hydrants

Hydrants shall be wet-barrel type. Hydrants shall be factory painted with at least one coat of primer and two coats of yellow enamel paint. Stencil hydrant number and main size on the hydrant barrel using black stencil paint.

- a) Wet-Barrel Type Fire Hydrants: **AWWA C503** or **UL 246**, "Wet Barrel" design, shall have 6 inch inlet, one 4 ½ inch pumper connection, and two 2 1/2 inch hose connections. Pumper connection and hose connections shall be individually valved with independent nozzle gate valves. Inlet shall have flanged end; end shall conform to the applicable requirements as specified for the joint. Size and shape of operating nut, cap nuts, and threads on hose and pumper connections shall be as **AWWA C503** or **UL 246**. Hydrants shall be set on a breakaway spool with breakaway bolts designed to break from a force not less than that which would be imposed by a moving vehicle.
- b) A hydrant break-off check valve shall be installed between the breakaway spool and bury.

Manufacturer: Clow #76. Clow break-off check valve Model 400.

2.1.2.9 Indicator Posts

UL 789. Provide for gate valves where indicated.

2.1.2.10 Valve Boxes

Provide a traffic rated valve box for each gate valve on buried piping. Valve boxes shall be round, of precast concrete with a cast iron ring and lid. For boxes installed in pavement boxes shall be set flush with existing grade. Boxes installed in asphalt pavement shall be set in a cast in place concrete ring minimum 6 inches around the valve and 6 inches deep. For boxes installed in landscaped areas boxes shall be set slightly above grade in a cast in place concrete ring minimum 6 inches around the box and 6 inches deep. Provide a field cut 8 inch diameter PVC riser of required length to access the valve nut. Cast the word "WATER" on the lid.

Manufacturer: Christy G5.

2.1.2.11 Valve Pits

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown.

2.1.2.12 Meters

Meters shall be provided and installed by Contractor. Meters shall be Neptune T-10, residential or commercial type according to contract drawings. Meters shall be provided with R900i remote reader. For meters installed in vaults a sending module shall be mounted in a pre-drilled hole in the box lid.

2.1.2.14 Meter Vaults

Meters shall be installed in precast, reinforced concrete, fully enclosed vaults. Vault lids will have a pre-drilled hole 1-3/4" and will have a clearance of minimum 12" from top of meter. Vault lids shall be rated for H20 Incidental Traffic in landscaped areas and H20 Full Traffic Rating in paved areas. Identify cover as "WATER".

Manufacturer: Christy

2.1.2.17 Tracer Wire for Nonmetallic Piping

Provide bare solid copper or aluminum wire not less than 2.5 mm(0.10 inch) in diameter in sufficient length to be continuous over each separate run of nonmetallic pipe. Run tracer wire into valve boxes and terminate.

2.1.2.18 WARNING TAPE

Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW". Tape will be installed 12" above pipe.

2.1.2.19 Backflow Prevention Devices

AWWA approved devices will be used. Domestic and irrigation devices will use RP (Reduced Pressure) type devices. Fire systems will use double check valve type devices. All backflow devices will have 18 inch of clearance on all sides, top and bottom. Installations will not require a ladder to access for testing.

Manufacturer: Wilkins

2.2 WATER SERVICE LINE MATERIALS

2.2.1 Piping Materials

2.2.1.1 Copper Pipe and Associated Fittings

Pipe, [ASTM B 42](#), regular, threaded ends. Fittings shall be copper, brass or bronze, [ASME B16.15](#), 125 psi.

2.2.1.2 Copper Tubing and Associated Fittings

Tubing, [ASTM B 88](#), Type K. Fittings for solder-type joint, [ASME B16.18](#) or [ASME B16.22](#). Compression fittings are not allowed.

2.2.1.8 Ductile-Iron Piping

Comply with "Ductile-Iron Piping" subparagraph under paragraph "Water Distribution Main Materials."

2.2.1.9 Insulating Joints

Joints between pipe of dissimilar metals shall have a rubber-gasketed or other suitable approved type of insulating joint or dielectric coupling which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.2.2 Water Service Line Appurtenances

2.2.2.1 Corporation Stops

Ground key type; brass, [ASTM B 61](#) or [ASTM B 62](#); and suitable for the working pressure of the system. Corporation stops shall be domestically manufactured, threaded, brass, full port ball valves. Threaded ends for inlet and outlet of corporation stops, [AWWA C800](#).

Manufacturer: Mueller or equal.

2.2.2.2 Service Clamps

Service clamps used for repairing damaged cast-iron, steel, PVC or asbestos-cement pipe shall have a pressure rating not less than that of the pipe to be connected and shall be full circle, either single or double flattened strap type. Clamps shall have a stainless steel body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

2.2.2.3 Service Connection Saddles

Saddles shall be brass or epoxy coated ductile iron with double stainless steel straps and stainless steel bolts.

Manufacturer: Smith Blair or approved equal.

2.2.2.4 Goosenecks

Type K copper tubing. Joint ends for goosenecks shall be appropriate for connecting to corporation stop and service line. Where multiple gooseneck connections are required for an individual service, goosenecks shall be connected to the service line through a suitable approved brass or bronze branch connection; the total clear area of the branches shall be at least equal to the clear area of the service line. Length of goosenecks shall be in accordance with standard practice.

2.2.2.5 Dielectric Fittings

Dielectric fittings shall be installed between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains. Dielectric fittings shall prevent metal-to-metal contact of dissimilar metallic piping elements and shall be suitable for the required working pressure.

2.2.2.6 Check Valves

Check valves shall be designed for a minimum working pressure of 150 psi. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 2 inches and larger shall be outside lever and spring type.

- a. Valves 2 inches and smaller shall be all bronze designed for screwed fittings, and shall conform to **MSS SP-80**, Class 150, Types 3 and 4 as suitable for the application.

2.2.2.7 Gate Valves 80 mm (3 Inch) Size and Larger

Comply with subparagraph 2.1.2 "Valves, Hydrants, and Other Water Main Accessories" under paragraph "Water Distribution Main Materials."

2.2.2.8 Gate Valves Smaller than 80 mm (3 Inch) in Size

Gate valves smaller than 3 inch size **MSS SP-80**, Class 150, solid wedge, nonrising stem. Valves shall have flanged or threaded end connections, with a union on one side of the valve for pit mounted installations, only. Provide handwheel or 2 inch nut operators when installed in pits. Provide with a 2 inch nut for operation with a valve key when installed in valve boxes.

2.2.2.9 Isolation Valves

Brass full port ball valves for installation in box or vault.

Manufacturer: Mueller or approved equal.

2.2.2.12 Valve Boxes

Provide a valve box for each gate valve and corporation stop on buried piping. Comply with subparagraph 2.1.2.10 "Valve Boxes" under paragraph "Water Distribution Main Materials."

2.2.2.14 Water Meters

Meters will be provided by the Presidio Trust and installed by the contractor according to the installation requirements in Section "Execution".

2.2.2.17 Meter Boxes

Meters shall be installed in precast, reinforced concrete vaults. Vault lids will have a pre-drilled hole 1-3/4" and will have a clearance of minimum 12 inch from top of meter. Identify cover as "WATER". Vault lids shall be H-20 rated.

Manufacturer: Christy B series utility boxes.

2.2.2.18 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: **AWWA B301**.

Hypochlorite, Calcium and Sodium: Calcium hypochlorite shall conform to AWWA B300 supplied in a tablet form and shall contain 65 percent chlorine by weight. Sodium Hypochlorite shall contain 12.5% chlorine by weight.

PART 3 EXECUTION

3.1 INSTALLATION OF PIPELINES

3.1.1 General Requirements for Installation of Pipelines

These requirements shall apply to all pipeline **installation** except where specific exception is made in the "Special Requirements..." paragraphs.

PVC pipe shall not be used for reservoir tie-ins and applications subject to high pressures and hydraulic surges.

3.1.1.1 Location of Water Lines

Terminate the work covered by this section at a point approximately 5 feet from the building, unless otherwise indicated.

Maintain a minimum separation of 12 inches between copper and ferrous piping when pipes cross or are laid in a common trench.

Where water piping is required to be installed within 1 m 3 feet of existing structures, the water pipe shall be sleeved as required in Paragraph "Casting Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

3.1.1.2 Water Main Separation

Where water piping is required to be installed in the proximity of sewer mains the separation distances specified as follows in Title 22 California Code of Regulation, Safe Drinking Water Act, Section 64572 shall be met.

(a) New water mains and new supply lines shall not be installed in the same trench as, and shall be at least 10 feet horizontally from and one foot vertically above, any parallel pipeline conveying:

- (1) Untreated sewage,
- (2) Primary or secondary treated sewage,
- (3) Disinfected secondary-2.2 recycled water (defined in CCR Title 22, section 60301.220),
- (4) Disinfected secondary-23 recycled water (defined in CCR Title 22, section 60301.225), and
- (5) Hazardous fluids such as fuels, industrial wastes, and wastewater sludge.

(b) New water mains and new supply lines shall be installed at least 4 feet horizontally from, and one foot vertically above, any parallel pipeline conveying:

- (1) Disinfected tertiary recycled water (defined in CCR Title 22, section 60301.230), and
- (2) Storm drainage.

(c) New supply lines conveying raw water to be treated for drinking purposes shall be installed at least 4 feet horizontally from, and one foot vertically below, any water main.

(d) If crossing a pipeline conveying a fluid listed in subsection (a) or (b), a new water main shall be constructed no less than 45-degrees to and at least one foot above that pipeline. No connection joints shall be made in the water main within eight horizontal feet of the fluid pipeline.

(e) The vertical separation specified in subsections (a), (b), and (c) is required only when the horizontal distance between a water main and pipeline is less than ten feet.

(f) New water mains shall not be installed within 100 horizontal feet of the nearest edge of any sanitary landfill, wastewater disposal pond, or hazardous waste disposal site, or within 25 horizontal feet of the nearest edge of any cesspool, septic tank, sewage leach field, seepage pit, underground hazardous material storage tank, or groundwater recharge project site.

(g) The minimum separation distances set forth in this section shall be measured from the nearest outside edge of each pipe barrel.

When new water mains, new sanitary sewer mains, or other nonpotable fluid carrying pipelines are being installed in existing developed areas, local conditions (e.g., available space, limited slope, existing structures) may create a situation in which there is no alternative but to install water mains, sanitary sewer mains, or other nonpotable pipelines at a distance less than that required by the regulations. In such cases through permit action California DPH may approve alternate construction criteria. Contractor shall request and receive approval through the COTR, California DPH approval prior to performance of alternative construction criteria.

3.1.1.2 Earthwork

Perform earthwork operations in accordance with Section 31 00 00, EARTHWORK.

3.1.1.3 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Do not under any circumstances drop or dump pipe, fittings, valves, or any other water line material into trenches. Cut pipe in a neat workmanlike manner accurately to length established at the site and work into place without springing or forcing. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material. Blocking or wedging between bells and spigots will not be permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at proper elevation and grade. Secure firm, uniform support. Wood support blocking will not be permitted. Lay pipe so that the full length of each section of pipe and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports where necessary for fastening work into place. Make proper provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been properly made. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Depth of cover over top of pipe shall not be less than 3 feet.

3.1.1.4 Installation of Tracer Wire and Marking Tape

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

Install marking tape for the full length of each run of pipe regardless of the material type or service. Lay the tape 1 foot above the top of pipe on the compacted lift of soil.

3.1.1.5 Connections to Existing Water Lines

Connections to existing water mains shall be inspected and approved prior to backfill. Contractor shall notify the Project Manager 24 hours in advance of inspection.

3.1.1.6 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or C900 PVC wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space between pipe and sleeves shall be filled with a link seal.

3.1.1.7 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

3.1.2 Special Requirements for Installation of Water Mains

3.1.2.1 Installation of Ductile-Iron Piping

Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the requirements of **AWWA C600** for pipe installation, joint assembly, valve-and-fitting installation, and thrust restraint.

a. **Jointing:** Pipe-to-pipe joints shall be bell and spigot or mechanical joint. Joints for fittings, valves, couplings and appurtenances shall be mechanical joint or flanged. Push on joint type fittings and valves shall not be used. Flanged joints shall only be installed above grade or below grade in a pit. Make bell and spigot joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of **AWWA C600** for joint assembly. Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of **AWWA C600** for joint assembly and the recommendations of Appendix A to **AWWA C111/A21.11**. Make flanged joints with the gaskets, bolts, and nuts specified for this type joint. Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories. Align bolt holes for each flanged joint. Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted. Do not allow adjoining flange faces to be out of parallel to such degree that the flanged joint cannot be made watertight without overstraining the flange. When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions. Use setscrewed flanges to make flanged joints where conditions prevent the use of full-length flanged pipe and assemble in accordance with the recommendations of the setscrewed flange manufacturer. Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint. Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves shall be full size for the bolt holes. Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

b. **Allowable Deflection:** The maximum allowable deflection shall be as given in **AWWA C600**. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

c. **Pipe Anchorage:** Provide concrete thrust blocks and joint restraints for pipe anchorage at all turns, Tees and 'Y's. Thrust blocks shall be in accordance with the requirements of **AWWA C600** for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, **ASTM C 94/C 94M**, having a minimum compressive strength of 15 MPa(2,500 psi) at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

d. **Joint Restraints:** All joints, fittings, valves and couplings including but not limited to connection between new and existing pipe, cut-in connections to existing water mains, pipe-to-pipe joints, pipe-to-fitting joints and pipe-to-valve joints shall be restrained with Megalug series joint restraints or approved equal for the type of joint and type of pipe material installed. Contractor shall submit and receive approval on methods of restraining each type of joint prior to start of work. Field lock type gaskets shall not be used.

3.1.2.2 Installation of PVC Plastic Water Main Pipe

Installation of PVC Plastic Water Main Pipe and Associated Fittings: Unless otherwise specified, install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines"; with the requirements of **UBPPA UNI-B-3** for laying of pipe, joining PVC pipe to fittings

and accessories, and setting of hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in [AWWA M23](#), Chapter 7, "Installation."

- a. Jointing: Joints for pipe-to-pipe shall be bell and spigot with restraint. Joints for fittings, valves, couplings and appurtenances shall be mechanical joint. Push on joint type fittings and valves shall not be used. Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe bell and spigot joint connections, use only pipe with bell and spigot joint ends having factory-made bevel. Use an approved lubricant recommended by the pipe manufacturer for bell and spigot joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of [UBPPA UNI-B-3](#) for laying the pipe and the recommendations in [AWWA M23](#), Chapter 7, "Installation," for pipe joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of [UBPPA UNI-B-3](#) for joining PVC pipe to fittings and accessories, with the applicable requirements of [AWWA C600](#) for joint assembly, and with the recommendations of Appendix A to [AWWA C111/A21.11](#). Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using.
- b. Offset: Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.
- c. Pipe Anchorage: Provide concrete thrust blocks and joint restraints for pipe anchorage at all turns, tees and 'Y's. Thrust blocks shall be in accordance with the requirements of [AWWA C600](#) for thrust restraint, except that size and positioning of thrust blocks shall be as indicated. Use concrete, [ASTM C 94/C 94M](#), having a minimum compressive strength of 15 MPa(2,500 psi) at 28 days; or use concrete of a mix not leaner than one part cement, 2 1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
- d. Joint Restraints: All joints, fittings, valves and couplings including but not limited to connection between new and existing pipe, cut-in connections to existing water mains, pipe-to-pipe joints, pipe-to-fitting joints and pipe-to-valve joints shall be restrained with Megalug series joint restraints or approved equal for the type of joint and type of pipe material installed. Contractor shall submit and receive approval on methods of restraining each type of joint prior to start of work. Field lock type gaskets shall not be used.
- e. Fittings: Install in accordance with [AWWA C605](#).

3.1.2.8 Installation of Valves and Hydrants

- a. Installation of Valves: Install gate valves, [AWWA C500](#) and [UL 262](#), in accordance with the requirements of [AWWA C600](#) for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to [AWWA C500](#). Install gate valves, [AWWA C509](#), in accordance with the requirements of [AWWA C600](#) for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to [AWWA C509](#). Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in [AWWA M23](#), Chapter 7, "Installation." Install check valves in accordance with the applicable requirements of [AWWA C600](#) for valve-and-fitting installation. Make and assemble joints to gate valves [and

check valves] as specified for making and assembling the same type joints between pipe and fittings.

b. Installation of Hydrants: Install hydrants in accordance with **AWWA C600** for hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Hydrant bury shall have joints restraints and a concrete thrust block installed. Install hydrants with the 115 mm(4 1/2 inch) connections facing the adjacent paved surface. If there are two paved adjacent surfaces, contact the Contracting Officer for further instructions.

3.1.3 Installation of Water Service Piping

3.1.3.1 Location

Connect water service piping to the building service where the building service has been installed. Where building service has not been installed, terminate water service lines at a point directed by the Contracting Officer; such water service lines shall be closed with plugs or caps.

3.1.3.2 Service Line Connections to Water Mains

Connect service lines 50 mm(2 inch) size to the main with a service saddle and corporation stop for services up to 2 inch and a gate valve for services larger than 2 inch. Connect service lines to ductile-iron water mains in accordance with **AWWA C600** for service taps. Connect service lines to PVC plastic water mains in accordance with **UBPPA UNI-B-8** and the recommendations of **AWWA M23**, Chapter 9, "Service Connections."

3.1.4 Special Requirements for Installation of Water Service Piping

3.1.4.1 Installation of Metallic Piping

Install pipe and fittings in accordance with paragraph entitled "General Requirements for Installation of Pipelines" and with the applicable requirements of **AWWA C600** for pipe installation, unless otherwise specified.

a. Jointing:

(1) Screwed Joints: Make screwed joints up tight with Teflon tape and joint compound; apply to male threads only. Threads shall be full cut; do not leave more than three threads on the pipe exposed after assembling the joint.

(2) Joints for Copper Tubing: Cut copper tubing with square ends; remove fins and burrs. Handle tubing carefully; replace dented, gouged, or otherwise damaged tubing with undamaged tubing. Make solder joints using **ASTM B 32**, 95-5 tin-antimony or Grade Sn96 solder. Solder and flux shall contain not more than 0.2 percent lead. Before making joint, clean ends of tubing and inside of fitting or coupling with wire brush or abrasive. Apply a rosin flux to the tubing end and on recess inside of fitting or coupling. Insert tubing end into fitting or coupling for the full depth of the recess and solder. Compression joints are not allowed.

(3) Flanged Joints: Make flanged joints up tight, taking care to avoid undue strain on flanges, valves, fittings, and accessories.

3.1.4.3 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with **NFPA 24**.

3.1.4.4 Installation and Location of Meters

Meters and meter boxes shall be installed at the locations shown on the drawings or as directed by the Project Manager.

For meters installed in vaults the meters shall be centered in the vault to allow for reading and ease of removal or maintenance. Meters shall be installed with ball valves on both inlet and outlet side of meter. Valves shall be the same nominal size as the service line piping in which installed on both the inlet and outlet side of the meter. There shall be a minimum of 12 inches of clearance between the top of the meter and the underside of the vault lid. Meters and valves will fit inside of meter box/vault.

3.1.5 Disinfection

Prior to disinfection, obtain Contracting Officer approval of the proposed method for disposal of waste water from disinfection procedures. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with **AWWA C651**. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 and 0.5 parts per million, or the residual chlorine content of domestic water supply. Obtain at least two consecutive satisfactory bacteriological samples from new water piping, analyze by a CA Dept of Health certified laboratory, and submit the results prior to the new water piping being placed into service. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the CA Dept. of Health Services and the Presidio Trust. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor. Backflow preventers and meters shall not be in place during the flushing.

3.1.6 Flushing

Initial flushing shall obtain a minimum velocity in the main of 0.75 m/sec (2.5 feet per second) at 40 PSI residual pressure in water main. The duration of the flushing shall be adequate to remove all particles from the line. Flush tests shall be observed by the Presidio Trust and/or Presidio Fire Dept.

Pipe Diameter		Flow Required to Produce 2.5 ft/sec(approx.) Velocity in Main		Number of Hydrant Outlets			
				Size of Tap. in. (mm)			
				1(25)	1 ½(38)	2(51)	2 1/2-in (64 mm)
In	(mm)	gpm	(L/sec)	Number of taps on pipe			
4	(100)	100	(6.3)	1	--	--	1
6	(150)	200	(12.6)	--	1	--	1
8	(200)	400	(25.2)	--	2	1	1
10	(250)	600	(37.9)	--	3	2	1
12	(300)	900	(56.8)	--	--	3	2

16	(400)	1,600	(100.9)	--	--	4	2
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3.2 FIELD QUALITY CONTROL

3.2.1 Connection and Testing Plan

Contractor shall submit a Connection and Testing Plan for the new addition to the water system. This Connection and Testing Plan shall specifically address the requirements for connections to the existing system, including but not limited to identifying the point of loading, chlorine feed location, minimum duration of flushing, possible points for disposal of water, and sampling locations. Calculations of the anticipated volume of water and the minimum duration of flushing required to perform the flushing and testing shall be submitted with the Project Plans. All valves, taps and appurtenances and duration of flushing needed to meet these requirements shall be indicated on the Project Plans.

3.2.2 Field Tests and Inspections

Prior to hydrostatic testing, obtain Contracting Officer approval of the proposed method for disposal of waste water from hydrostatic testing. The Contracting Officer will conduct field inspections and witness field tests specified in this section. Hydrostatic testing of the system will be performed after disinfection. It may occur prior to disinfecting the system, provided the pipe section(s) is not attached to an 'in-service' water main. The Contractor shall perform field tests, and provide labor, equipment, and incidentals required for testing. The Contractor shall produce evidence, when required, that any item of work has been constructed in accordance with the drawings and specifications. Do not begin testing on any section of a pipeline where concrete thrust blocks and joint restraints have not been provided.

3.2.3 Testing Procedure

Test water mains and water service lines in accordance with the applicable specified standard, except for the special testing requirements given in paragraph entitled "Special Testing Requirements." Test ductile-iron water mains and water service lines in accordance with the requirements of [AWWA C600](#) for hydrostatic testing. The amount of leakage on ductile-iron pipelines with mechanical-joints or push-on joints shall not exceed the amounts given in [AWWA C600](#); no leakage will be allowed at joints made by any other method. Test PVC plastic water mains in accordance with the requirements of [UBPPA UNI-B-3](#) for pressure and leakage tests. The amount of leakage on pipelines made of PVC plastic water main pipe shall not exceed the amounts given in [UBPPA UNI-B-3](#), except that at joints made with sleeve-type mechanical couplings, no leakage will be allowed. Test water service lines in accordance with applicable requirements of [AWWA C600](#) for hydrostatic testing. No leakage will be allowed at copper pipe joints, copper tubing joints (soldered, brazed), flanged joints and screwed joints.

3.2.4 Special Testing Requirements

For pressure test, use a hydrostatic pressure 375 kPa(50 psi) greater than the maximum working pressure of the system, except that for those portions of the system having pipe size larger than 3 inches in diameter, hydrostatic test pressure shall be not less than 1400 kPa(200 psi). Hold this pressure for not less than 2 hours. Prior to the pressure test, fill that portion of the pipeline being tested with water for a soaking period of not less than 24 hours. For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.