**SECTION 33 11 00**

# water UTILITY distribution PIPING

**BASED ON DFD MASTER SPECIFICATION DATED 09/01/2015**

This section has been written to cover most (but not all) situations that you will encounter. Depending on the requirements of your specific project, you may have to add material, delete items, or modify what is currently written. The Division of Facilities Development expects changes and comments from you.

***Modify this document to account for project specific conditions.***

***Note to the Designer: If project also includes plumbing coordinate this section with:***

* ***Section 22 11 00 – Facility Water Distribution***

 ***and clearly define party responsible for testing of the respective utility on the Drawings.***

# PART 1 - GENERAL

**SCOPE**

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide water distribution system components and other work, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. The limits of the work, including the responsible party for testing purposes, shall be clearly defined on the Drawings. Included are the following topics:

PART 1 - General

Scope

Related Work

Reference Documents

Reference Standards

Submittals

Continuity of Existing Water Distribution System

Provisions for Future Work

As-Built Drawings

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PVC Watermain

HDPE Watermain

Copper Water Service

Ductile Iron Watermain Fittings

Polyethylene Fittings

Valves

Brass Water Service Fittings

Valve Boxes

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PART 3 - Execution

General

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Fittings, Valves and Hydrants

Joint Restraint

Copper Water Services and Brass Fittings

Filling Watermain

Pressure Testing

Electric Continuity Testing

Disinfection/Flushing

Bacteriological Sample

#### RELATED WORK

####

Applicable provisions of Division 1govern work under this section.

Related work specified elsewhere:

Section 02 32 00 – Geo Technical Investigation

Section 22 11 00 – Facility Water Distribution

Section 22 13 00 – Facility Sanitary Sewerage

Section 22 14 00 – Facility Storm Drainage

Section 30 05 00 – Common Work Results for All Exterior Work

Section 31 23 16.13 – Trenching

Section 31 25 00 – Erosion Control

#### reference dOCUMENTS

Where reference is made to the “SSSWC”, it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition. Method of measurement and basis of payment sections in referenced documents shall not apply.

Where these specifications do not cover portions of the work to be undertaken, the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition, shall govern the work.

#### reference standards

American Society for Testing and Materials (ASTM):

B88 Standard Specifications for Seamless Copper Water Tube

F477 Standard Specifications for Elastomeric Gaskets for Joining Plastic Pipe

D3139 Standard Specifications for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

D3350 Standard Specifications for Polyethylene Plastic Pipe and Fittings Materials

American Water Works Association (AWWA):

C502 Dry Barrel Fire Hydrants

C504 Rubber-Seated Butterfly Valves

C509 Resilient-Seated Gate Valves for Water Supply Service

C515 Reduced Wall, Resilient Seated Gate Valves for Water Supply Service

C550 Protective Epoxy Interior Coatings for Valves and Hydrants

C800 Underground Service Line Valves and Fittings

C900 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings for Water Distribution (4”-12”)

C905 Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings for Water Distribution (14”-48”)

C906 Polyethylene Pressure Pipe, and Fabricated Fittings for Water Distribution (4”-63”)

C104/ANSI A21.4 Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

C105/ANSI A21.5 Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

C111/ANSI A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

C151/ANSI A21.51 Standard for Ductile Iron Pipe, Centrifugally Cast

C153/ANSI A21.53 Standard for Ductile Iron Compact Fittings

### submittals

Provide manufacturers product information (cut sheets) and O&M information for watermain materials including:

* Pipe
* Fittings
* Valves
* Hydrants
* Joint Restraint Materials

Provide copies of all pressure and electric continuity testing procedures and results for the project to the DFD Project Representative and the AE within 48 hours of completing the individual tests.

Provide reports that document safe sample collection procedures and results.

**Continuity of existing water distribution system**

Provide a construction schedule to DFD Project Representative, municipal water utility (if applicable) and local fire department (if applicable) for review and approval prior to starting construction. Schedule shall indicate the date and time of all required water supply interruptions.

Do not interrupt existing water supply without approval from DFD Project Representative, municipal water utility, and local fire department.

Once approved, notify all distribution system users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages, and provide the name and number of Contractor’s foreman or other contact.

###### Provisions for future work

Note to the designer: Describe any specific provisions required to accommodate future watermain work.

Construct watermain system in a manner that will facilitate future extension or connection.

Unless otherwise shown on the drawings, provide valves on “dead end” mains that will allow dry connection to the watermain system. Terminate “dead end” mains with full length of pipe beyond the valve, and a bell end with restrained plug.

AS-Built drawings

Show the actual locations of watermain and services, valves and hydrants on drawings and show changes to proposed watermain size, alignment, or grades. Show the actual locations, sizes and types of underground utilities and other features encountered during construction.

# PART 2 - MATERIALS

Note to the designer: Edit material requirements to account for agency/institution and local utility requirements, or variations in material availability. Comply with the substantive requirements of the materials described below.

**Ductile iron watermain**

Ductile watermain shall be Class 52, ANSI/AWWA C151/A21.51centrifugally cast, cement mortar lined meeting the requirements of ANSI/AWWA C104/A21.4.

Ductile iron watermain joints shall be rubber gasket push-on joint or mechanical joint meeting the requirements of ANSI/AWWA C111/A21.11.

Pipe shall be provided with conductive bonding straps to provide electrical continuity.

Pipe shall be manufactured in the United States.

**PVC Watermain**

Note to the designer: Verify the necessary Dimension Ratio (DR) based on site specific conditions including vehicle loads, pipe diameter, depth, and soil type.

Polyvinyl chloride pipe shall have a dimension ratio (DR) of 18 or less and conform to the requirements of AWWA C900 (4”-12”) or AWWA C905 (14”-48”). Pipe shall meet applicable NSF standards for use in a potable water distribution system.

PVC watermain joints shall be rubber gasket push-on joint conforming to ASTM D 3139, using a gasket that conforms to ASTM F477.

**HDPE watermain**

Note to the designer: Verify the necessary Dimension Ratio (DR) based on site specific conditions including vehicle loads, pipe diameter, depth, and soil type.

Polyethylene Resin

Polyethylene resin used for manufacturing piping and fittings shall meet ASTM D1248 for Type III, Class C, Grade P34, Category 5, with a PPI recommended designation of PE3408 and a minimum cell classification of PE 345434C in accordance with ASTM D3350. The polyethylene compound shall be combined with carbon black to provide protection against degradation by ultraviolet light. Pipe shall be made from virgin material with no rework compound, except that obtained from the manufacturer’s own production of the same formulation.

Polyethylene Piping

High density polyethylene (HDPE) piping, shall meet the requirements of AWWA C906, current version. Pipe dimensions and workmanship shall be in accordance with ASTM F714 and ASTM D2122. Pipe shall be of diameter shown on the drawings, with dimension ratio (DR) of DR11, unless otherwise noted.

Pipe, fittings, and joints shall meet or exceed the following physical properties:

|  |  |  |
| --- | --- | --- |
| Property | ASTMTest method | Value |
| Density, gm/cc | D1505 | 0.955 |
| Melt Index, gm/10 min | d1238-e | 0.10 |
| High Load Melt Index, gm/10 min | D1238-F | 12.0 |
| Tensile Strength @ Break, psi | d638 | 4,500 |
| Tensile Strength @ Yield, psi | d638 | >3,200 |
| Elongation, % | d638 | >800 |
| Flexural Modulus, psi | d790 | 136,000 |
| Environmental Stress Cracking Resistance F20’ Hours (100°c) | d1693 (Cond. C) | >5,000 |
| Brittleness Temperature, °f | d746 | <-180 |
| Melting Point, °f | d789 | 261 |
| Vicat Softening Temperature, °f | d1525 | 255 |
| Hardness, Shore D | D2240 | 66 |
| Volume Resistivity, ohm-cm | D991 | 2.6 1016 |
| Recommended Hydrostatic Design Stress: |  | 1600 psi @ 73.4°F800 psi @ 140°F |

Pipe Marking

Each length of straight and special HDPE pipe and each HDPE fitting shall be plainly marked on the outside to identify the design pressure or class of pipe, proper location of the pipe or fitting in the pipeline, and the date of manufacture.

**copper water Service**

BELOW GROUND 2-1/2" AND SMALLER:

Type K copper water tube, O (annealed) temper, ASTM B88; with cast copper pressure fittings, ANSI B16.18; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; or cast copper flared pressure fittings, ANSI B16.26.

**ductile iron watermain fittings**

Fittings shall be ductile iron cement mortar lined mechanical joint compact style fittings meeting the requirements of ANSI/AWWA C153/A21.53.

Fittings shall be manufactured in the United States.

**POLYETHYLENE FITTINGS**

HDPE fittings manufactured in accordance with ASTM D2683 (socket fused) or ASTM D3261 (butt fused). Fittings shall be supplied by the HDPE piping manufacturer. Butt fusion outlets shall be made to the same dimensional characteristics and tolerances as the mating pipe. All fittings and custom fabrications shall be fully rated for the same internal pressure as the mating pipe. Pressure de-rated fabricated fittings are prohibited.

**valves**

Resilient Wedge Gate Valve

Resilient seated wedge gate valve meeting the requirements of AWWA C509 and C515. Body, bonnet and gate shall be constructed of ductile iron. Bolts shall be stainless steel.

Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Symmetrical wedge shall be completely encapsulated with resilient material.

Valve stem shall be non-rising, low-zinc (zinc content not to exceed 6%) bronze. Valve stem shall have an integral thrust collar. Thrust collar bearings shall be designed to withstand maximum torque without distortion.

Stem seal shall be so designed that the O – ring above the stem collar can be replaced while the valve is under pressure and in the fully open position.

Valve shall be left opening and be provided with standard 2” square operating nut.

Valve shall be provided with mechanical joint connections. Mechanical joint ends shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.

Mueller, Kennedy, US Pipe, American Flow Control, Clow, or approved equal.

Butterfly Valve

Rubber-seated butterfly valve meeting the requirements of AWWA C504, for Class 150B. Body and disc shall be constructed of ductile iron. Bolts shall be stainless steel. Disc shall be lens shaped.

Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Disc shall be provided with a stainless steel disc edge.

Valve stem shall be stainless steel. Packing shall be permanent duty “chevron V-type” or “O-ring” type. Bearings shall be permanent, non-metallic, and self-lubricating.

Valve seat shall be a single piece of elastomeric material that is not penetrated by the valve shaft.

Provide manual operator that is suitable for underground service and includes a standard 2” square operating nut.

Valve shall be provided with mechanical joint connections. Mechanical joint ends shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.

Mueller/Henry Pratt, Kennedy or approved equal.

Tapping Valve

Resilient seated wedge gate tapping valve having 100% port, and meeting the requirements of AWWA C509 and C515. Body, bonnet and gate shall be constructed of ductile iron. Bolts shall be stainless steel.

Interior and exterior surfaces of valve shall be provided with epoxy coating meeting the requirements of AWWA C550. Symmetrical wedge shall be completely encapsulated with resilient material.

Valve stem shall be non-rising bronze. Stem collar shall be provided with thrust bearings that are protected by upper and lower O-ring seals both above and below.

Valve shall be left opening and be provided with standard 2” square operating nut.

Valve shall be provided with flange connection on inlet side of valve and mechanical joint connections on outlet side of valve. Mechanical joint end shall conform to AWWA C509 and shall be furnished complete with all mechanical joint accessories including approved M.J. bolts and nuts. Glands shall be full body gray iron or ductile iron. Mechanical joint bells, glands and rubber gaskets shall be in accordance with AWWA C111.

Provide suitable companion tapping sleeve.

Mueller, US Pipe, American Flow Control, Clow, or approved equal.

**Brass Water Service fittings**

Note to the designer: Confirm brass water service fitting thread and connection type (i.e. flare/compression) with agency/institution or local utility.

Service Saddles

Double strap, bronze service saddles meeting the requirements of AWWA C800. Service saddles shall be provided with nitrile O-ring gasket and AWWA Taper outlet.

Service saddles shall be properly sized to accommodate both the main and service lines.

Mueller BR 2B Series, Ferguson, Romac, or approved equal.

Corporation Stops

Corporation stops shall be brass, ball style. Inlets shall be AWWA Taper; outlet connection shall be compression having a positive indicator to avoid over-tightening.

Corporation stops shall be Mueller B-25008, A.Y. McDonald Mfg. Co., or approved equal.

Curb Stops

Curb stops shall be brass, with compression connections having a positive indicator to avoid over-tightening . Curb stops shall be provided with a quarter turn check.

Curb stops shall be Mueller B-25209, A.Y. McDonald Mfg. Co., or approved equal.

Unions

Unions shall be 3-piece brass, with compression connections having a positive indicator to avoid over-tightening.

Unions shall be Mueller H-15403, A.Y. McDonald Mfg. Co., or approved equal.

U-Branch, Wyes, Etc.

U-branch, wye and other fittings shall be brass, with compression connections having a positive indicator to avoid over-tightening. Fittings shall be produced specifically for water supply applications.

Mueller, A.Y. McDonald Mfg. Co., or approved equal.

**valve boxes**

Note to the designer: Confirm valve box size and type with agency/institution or local utility.

Gate/Butterfly Valve Boxes

Valve boxes shall be screw type and shall consist of a base, middle section, top section with cover and intermediate extension sections. The top section shall be designed to thread onto the middle section so that the unit can be adjusted to a variable length. The top section shall be designed to receive a circular drop cover.

The valve box and component parts shall be cast iron in accordance with ASTM-A48 class 20, 30, 35, or approved equal.

Boxes shall be 5-1/4” with stay-put “WATER” cover.

The cast iron valve box and components shall be free from blowholes, cold shots, shrinkage defects, cracks or other injurious defects and shall have a normal smooth casting finish.

All cast iron valve boxes and components shall be thoroughly coated with asphaltic pitch varnish or approved equal.

Provide valve box extensions as necessary to accommodate depth of cover shown on drawings, or 6.5-foot minimum.

Valve boxes shall be Bingham & Taylor, East Jordan Iron Works, Tyler, or approved equal.

Curb Stop Boxes

Curb stop boxes shall be 1 1/4” minimum diameter, cast iron, arch style, valve boxes. Boxes shall be telescopic, extendable to accommodate 7’ bury. Lid shall be two piece threaded, with a plug having a pentagonal bolt for removal.

Provide valve box extensions as necessary to accommodate depth of cover shown on drawings, or 6.5-foot minimum.

Ford, Mueller, or approved equal.

**hydrants**

Note to the designer: Confirm hydrant, type, manufacturer, nozzle sizes and bury depth with agency/institution or local utility.

Fire hydrants shall be dry-bury type meeting the requirements of AWWA C110, C111, and C502.

Hydrants shall be ductile iron, 250 psi rated working pressure.

Hydrants shall be traffic rated as specified in AWWA C502 except which is modified to permit a complete 360 degree rotation, or any increment thereof.

Hydrants shall be provided with the following features:

* 7’ bury (6.5’ cover over lead)
* 6” mechanical joint inlet
* 5 ¼” main valve opening
* One 4 ½” pumper nozzle with National Standard Threads
* Two 2 ½” hose nozzles with National Standard Threads
* Nozzle caps with chains
* Pentagon operating nut, open counter-clockwise, conforming to AWWA C502. Material of the operating nut shall be either hardened bronze or ductile iron.
* Painted red. Painting shall be in accordance with AWWA C502.

All extensions shall be made for insertion below the breakable flange. Extensions shall be made from the same material as that of the barrel. The hydrant must be designed to allow the use of barrel extension kits, which allow the raising of the hydrant to a new grade while retaining the “Safety Coupling and Breakable Flange” traffic collision feature at the new grade. Extension kits are to be in 6” increments, with the shortest being 6” long.

All nozzles shall be at the same elevation. Nozzle shall be capable of being threaded into the upper barrel and shall be mechanically locked in place. The distance from the base of the operating nut to the center of the pumper nozzle shall not be less than 7-1/8”. The distance between the ground and the center of the pumper nozzle shall not be less than 15 inches nominal dimension.

Hydrant shall be Waterous, Mueller, U.S. Pipe, or approved equal.

**joint restraints**

Retainer Glands for Ductile Iron Pipe

Ductile iron wedge action retainer glands designed for use with ductile iron pipe.

Glands shall be constructed of. Restraint shall be provided by a minimum of three wedges that are tightened onto the exterior of the pipe using a threaded, torque limiting mechanism.

Glands shall be tested to provide restraint at 250 psi operating pressure.

EBAA Iron, Mueller AquaGrip, Romac Romagrip, or approved equal.

Retainer Glands for PVC Pipe

Wedge action retainer glands designed for use with PVC pipe.

Glands shall be constructed of ductile iron. Restraint shall be provided by a minimum of four wedges that are tightened onto the exterior of the pipe using a threaded, torque limiting mechanism.

Glands shall be tested to provide restraint at 200 psi operating pressure.

Retainer glands shall be MEGA-LUG by EBAA Iron, or approved equal.

EBAA Iron, Mueller AquaGrip, Romac Romagrip, or approved equal..

**polyethylene encasement Bag**

8-mil polyethylene encasement bag meeting the requirements of ANSI/AWWA C105/A21.5, Class “C” black.

**Board insulation**

Insulation shall be rigid, closed-cell extruded polystyrene insulation suitable for buried installation. Individual boards shall have minimum dimensions of 8’x4’x2”.

Owens Corning, Dow Styrofoam, or approved equal.

**tracer wire**

Tracer wire shall be #10 solid copper wire with insulated jacket. Tracer wire insulation color for non-metallic, potable water pipe shall be blue. Tracer wire insulation color for non-metallic, non-potable water pipe shall be purple.

**locator tape**

Tape shall be detectable metallic locator tape, specifically manufactured for marking utilities with a minimum width of 6 inches and detectable at a depth of 18”.

Tape for potable water shall be marked “WATER” and blue colored. Tape for non-potable water shall be marked “NON-POTABLE WATER” and purple colored.

**chlorine**

Chlorine disinfectant shall be calcium hypochlorite tablets or granules. Calcium hypochlorite product shall meet requirements for AWWA C651 – Standard for Disinfecting Water Mains - latest revision.

Arch “HTH”, or approved equal.

**Pipe joint lubricant**

Petroleum free pipe lubricant formulated for use with potable water systems. Product shall meet the requirements of ANSI/AWWA C111/A21.11 - latest revision.

**PART 3 - EXECUTION**

**General**

Complete exploratory excavations at utility crossings as shown on the drawings and as necessary to complete the work.

Maintain clearances between watermains and existing or proposed sewer lines as follows:

* 8’ horizontal separation (measured center to center) between watermains and existing or proposed sanitary or storm sewers.
* 12” vertical separation (measured from outsides of pipes) where watermains cross over sanitary or storm sewers.
* 18” vertical separation (measured from outsides of pipes) where watermains cross under sanitary or storm sewers.

Notify the A/E and DFD Project Representative of utility conflicts as soon as they are encountered.

Store and handle pipe in accordance with manufacturers’ recommendations. Keep pipes clean of soil, debris and animals.

Watermain construction shall be completed in a manner that minimizes interruptions to existing services.

**connections to existing watermains/tapping**

Provide tapping sleeves, valves, cutting-in sleeves and other materials specifically manufactured for use with the type of pipe to which the connection is being made.

Notify the DFD Project Representative if the proposed point of connection is located within 4’ of an existing joint.

Connections shall be made at existing pipe stubs, valves or other fittings.

At connections to existing mains, locate the new valve as close to the existing main as possible. Swab the interior surfaces of all pipe, fittings, valves that will be exposed to the existing system. Swab solution shall consist of a 5% (by weight) solution of calcium hypochlorite.

**bedding /utility cover**

Provide bedding and utility cover in accordance with the applicable requirements of Section 31 23 16.13 – Trenching.

Watermain and water service piping shall be provided with 6” of bedding material and 12” of utility cover material (both measured at the bell of the pipe).

Note to the designer: Coordinate the bedding and cover material types with 31 23 16.13. Modify as necessary to remove unused or unspecified materials.

Bedding and cover material for various types of pipe shall consist of the following:

* Ductile Iron Watermain: Bedding sand or crushed stone screenings.
* PVC Watermain: Crushed stone bedding.
* Copper Water Services: Bedding sand or crushed stone screenings.

**laying watermain**

Install pipe in accordance with the SSSWC and ASTM specifications that pertain to the specified type of pipe material and the installation situation.

Provide a minimum of 6.5’ of cover over watermain, unless otherwise shown on the drawings or directed by the DFD Project representative. For watermains with less than 6.5’ of cover, provide insulation as shown on the drawings, or as directed by the DFD Project Representative.

Lay watermain at uniform grades between deflection points shown on the drawings; do not install watermains with intermediate high points.

Unless otherwise shown or approved by the DFD Project Representative, lay pipe with bell end facing the direction of pipe laying.

For ductile iron watermain, place polyethylene encasement bag on watermain prior to lowering into trench. Once pipe is joined, pull bag over entire length of pipe, overlap joint at adjacent pipe and secure using “Duct” tape or other approved method.

Prepare pipe bell and gasket in accordance with manufacturers requirements. Lubricate bell and/or pipe with AWWA/NSF approved lubricant.

Push pipe home in accordance with manufacturer’s recommendations regarding tools and methods.

Pipe joint deflection shall not exceed manufacturer’s requirements.

For ductile iron pipe, connect bonding straps or lugs to provide electrical continuity along entire watermain. Provide exothermic weld to attach new bonding straps, when existing straps are missing or damaged. Follow manufacturer’s requirements for exothermic welding procedures.

Locate the geographic location of all dead end watermains and services and note actual location on As-Built Drawings.

Disinfect pipe by placing calcium hypochlorite in each section of pipe as pipe laying progresses. Provide dosage as indicated on Table 33 11 00-1.

|  |  |
| --- | --- |
| Watermain Nominal Diameter(inches) | Dose Calcium Hypochlorite\*(oz./length pipe) |
| 4-6 | 1 |
| 8 | 3 |
| 10 | 5 |
| 12 | 7 |

\* Granular/tablet calcium hypochlorite with 68% (weight) available chlorine

Table 33 11 00-1

When required, provide board insulation in the thickness and width shown on the drawings. Unless otherwise shown, insulation shall be provided at a minimum thickness of 2 inches.

Install insulation on compacted initial cover material 6 inches above the top of pipe. Stagger joints when placing multiple layers of insulation.

Provide insulation with a minimum of 1 foot of utility cover material. Place backfill material in manner that does not damage insulation; replace damaged insulation.

**TRACER WIRE**

Note to the designer: Coordinate with the current version of Safety and Professional Services (SPS) 382 Locating Requirements.

Provide tracer wire for buried non-metallic water piping. Tracer wire shall be installed directly above the top of pipe and within six inches of the pipe.

Splices in tracer wire shall be made with split-bolt or compression-type connectors.

Access points are required every 400 feet. At access points the tracer wire shall be brought to grade in valve boxes, utility structures or other covered access devices.

**LOCATOR TAPE**

Install locator tape directly above new non-metallic sanitary sewer pipe approximately 15 inches below finished grade. Bring tape to surface and terminate in valve box or other structure.

**fittings, valves and hydrants**

Install fittings, valves and hydrants at locations shown on the drawings.

Unless otherwise shown, provide restrained mechanical joint connections. Install materials in accordance with manufacturer’s recommendations.

Maintain electrical continuity through all fittings, valves and hydrants. Provide and install suitable jumper cables for epoxy coated valves.

Place hydrants and valves on 4”x8”x16” solid concrete masonry units set on compacted soil.

Install joint restraints in accordance with the requirements of this section.

Install valve box so that bonnet rests on compacted initial backfill material at the same elevation as the top of the valve stuffing box. Center the valve box over the valve nut.

Install valve box plumb and level, backfilling evenly. Extend valve box to proposed final grade; provide valve box extensions as necessary. Valve boxes that shift during backfilling or restoration shall be excavated and re-set.

Mark all valve boxes with a steel “U” fence post to protect them from damage.

Install hydrants at elevation shown on drawings or as required to provide a minimum of 6.5’ cover over the hydrant lead.

Place approximately ½ cy of clear stone bedding material from the base of the hydrant to 6” above the drain holes on the hydrant elbow. Cover clear stone material with a “skirt” of polyethylene encasement bag material to prevent backfill material from migrating into the clear stone.

Install hydrant plumb and level, backfilling all sides evenly.

Cover all new hydrants with a plastic garbage bag or similar cover until the main has been filled and placed in service.

**joint restraint**

Note to the designer: Evaluate joint restraint requirements on a project specific basis.

Unless otherwise noted, all fittings, valves and hydrants shall be installed with restrained joints. Joint restraints shall be used on the adjacent full length (or more lengths as shown on the drawings) of pipe on all sides of fittings. Additionally, branch runs of pipe shall be installed with restrained joints beginning at the fitting at the main to the first valve.

Hydrant leads shall be provided with restrained joints beginning at the fitting at the main to the hydrant.

Joint restraint shall be provided using retainer glands.

Install all joint restraint products in accordance with manufacturer’s recommendations and drawings.

**copper water services and brass fittings**

Connect copper water service piping to watermain, wellhouse, or other supply as shown on the drawings.

Watermain taps shall be made under pressure using a tapping machine specifically designed to tap and install corporation stops. Dry watermain taps are not allowed.

Service saddles shall installed on services where the corporation stop is 1 ½” nominal diameter or greater.

Provide a horizontal offset adjacent to the main for all copper services. Comply with pipe manufacturer’s requirements with respect to minimum radius on bends.

Install curb stops as shown on the drawings. If specific curb stop location is not shown on the drawings, consult with DFD Project Representative to determine acceptable location prior to installing.

Place curb stop box on a 4”x8”x8” solid concrete masonry unit set on compacted ground. Orient box so that no portion of the box bears on the water service or curb stop.

Install curb stop box plumb and level and backfill all side simultaneously. Extend curb stop box to proposed final grade; provide extensions as necessary. Curb stop boxes that shift during backfilling or restoration shall be excavated and re-set.

Install copper water service as shown on the drawings. Prepare copper pipe joints in accordance with pipe and fitting manufacturer recommendations. Cut pipe squarely, remove burs and round ends as necessary.

Install fittings in accordance with manufacturer’s recommendations. Torque compression connections to recommended tightness; do not over-tighten compression joints.

Provide dead-end copper water services with compression connectors fitted with plugs. Do not tap or crimp the ends of copper water services shut.

Locate the geographic location of all dead end services and curb stop boxes and note actual location on As-Built Drawings.

**Filling watermain**

Fill watermain after main has been installed and completely backfilled.

Fill main slowly to limit entrapped air and evenly distribute calcium hypochlorite. Open all hydrants completely to allow air to escape and monitor filling.

Once main is full, allow a minimum of 48 hours of time for disinfection to occur before flushing.

**pressure testing**

***Note to the designer: If project involves watermain that is or will be owned by a municipality, modify testing requirements to comply with municipality practices. If water service also serves as a fire protection service, modify to match NFPA fire service testing requirements.***

Pressure test all watermain and copper water services.

Provide all valves, fittings, joint restraints, hoses, compressors, water and power supply as necessary to complete pressure testing. Utilize testing apparatus that is fabricated specifically for testing watermains. Calibrate pressure gauges as necessary.

Flush main as necessary to remove air prior to testing. Comply with the requirements of this section with respect to flushing.

For longer installations or installations consisting of watermain and copper water service, the Contractor may elect to pressure test the system in short segments.

All pressure testing shall be conducted in the presence of the DFD Project Representative. Provide minimum of 48 hours advanced notice of testing.

Conduct a combined pressure/leakage test for 1 hour at a pressure equal to 150% of system normal operating pressure (as measured at the lowest point in the system), or a minimum pressure of 150 psig.

When conducting test, pressure test equipment shall be set-up as close to the highest point in the line as possible.

Make-up water for the test shall be clean potable water supplemented with ½ oz of dry calcium hypochlorite per 35 gallons of water.

Leakage for test shall not exceed gallons per hour as allowed by the attached formula:

G=(ND√P)/7400

Where: G= Allowable leakage (gallons per hour of test)

 N=Number of joints under test

 D=Nominal diameter of main (inches)

 P=Average pressure during test (psig)

Allowable leakage for high density polyethylene pipe shall be zero.

Record and document pressure test by recording the following information:

* Date of test
* Section tested
* Diameter and length of main under test
* Number of fittings, valves hydrants, etc.
* Results of test including test length, pressure, actual water loss
* Calculation of allowable leakage
* If a failed test, describe actions taken to eliminate leaks and results of re-testing

Submit reports documenting pressure testing.

**Electric continuity testing**

Conduct electric continuity test on all ductile iron watermain and copper water services.

The electric continuity test shall be performed using a multi-meter to verify electrical continuity of the watermain system.

The Contractor shall furnish all labor and equipment necessary to conduct the electric continuity test.

Document electric continuity testing by recording the following information:

* Date of test
* Test methods and equipment
* Section tested
* Diameter and length of main under test
* Number of fittings, valves hydrants, etc.
* Results of test including resistance
* If a failed test, describe actions taken to eliminate leaks and results of re-testing

Submit reports documenting electric continuity testing.

**disinfection/flushing**

After filling the main, allow a minimum of 48 hours of time for disinfection to occur before flushing.

Flush all sections of watermain and water service. When possible, utilize hydrants or other large diameter orifices to complete flushing and achieve 2.5 fps water velocity. If needed, utilize services or temporary connections to complete flushing.

All watermain and services shall be flushed for a minimum of 10 minutes, or as necessary to obtain a sediment-free and bacteriologically safe sample.

Utilize diffusers, hoses, settling basins and other devices as necessary to limit erosion and other damage to the site and downstream areas.

Contractor shall be responsible for providing all necessary fitting, valves, joint restraints, hydrants and other materials necessary to conduct flushing.

Submit reports documenting disinfection and flushing.

**Bacteriological Sample**

Following all pressure testing and flushing, the contractor shall collect a sample from the newly installed watermain or water service(s). Samples shall be submitted to the State Laboratory of Hygiene, or other licensed testing laboratory for bacteriological (coliform bacteria) analysis.

The Contractor shall be responsible for all costs associated with sample collection(s) and analysis.

Document bacteriological sample collection and analysis by recording the following information:

* Date of sample collection
* Sample collection methods and equipment
* Person collecting the sample
* Location(s) sample was collected
* Results of sample analysis

If sample results indicate water is “Unsafe – Coliform Bacteria Present”, Contractor shall re-disinfect watermain and water services by introducing additional chlorine into the line and re-flushing the main. This process shall be repeated as necessary until a clean sample is obtained. The Contractor shall be responsible for all costs associated with all efforts necessary to obtain a “Safe – Coliform Bacteria Not Present” sample.

Submit reports documenting bacteriological sample collection and analysis.

**END OF SECTION**