Chapter 6 Table of Contents

Section 610 – General Requirements 6
610.1 Scope 6
610.2 General Design Requirements 6
610.2.1 Public Water Easement 7
610.3 General Material Requirements 7
610.4 General Construction Requirements 7
610.4.1 Maintaining Existing Service 8
610.4.2 Non-Emergency Water Shut-off Notification 8
610.4.3 Bulk Water 8
610.4.4 Valve Operation 8
610.4.5 Staking Requirements 9
Section 620 Trenching, Backfill, and Surface Restoration 10
620.1 Design Requirements 10
620.1.1 Erosion/Sediment Control 10
620.2 Materials 10
620.2.1 Foundation Stabilization Materials 10
620.2.2 Bedding and Pipe Zone Materials 10
620.2.3 Backfill Materials 10
620.3 Construction 10
620.3.1 Excavation 10
620.3.2 Trenching Requirements 11
620.3.3 Pipe Bedding and Trench Backfill 11
620.3.4 Compaction Testing 12
Section 630 Water Main Piping 14
630.1 Design Requirements 14
630.1.1 Pipe Sizes 14
630.1.2 Pipe Location 14
630.1.3 Pipe Depth 14
630.1.4 Pipe Deflection 14
630.1.5 Clearances from Other Utilities 15
630.1.6 Pipeline Extensions 16

630.1.7 Dead-End Mains....16
630.1.8 Blow-off Assemblies....16
630.1.9 Auto-Flushers....16
630.2 Materials....16
630.2.1 Ductile Iron Pipes....16
630.2.2 Push-on Joints....17
630.2.3 Ductile Iron Fittings....17
630.2.4 Mechanical Joint Fittings and Restraints....17
630.2.5 Flange Joints....18
630.2.6 Restrained Flange Coupling Adaptors/Dismantling Joints....18
630.2.7 Tapping Sleeves....18
630.2.8 Polyethylene Encasement....18
630.2.9 Casing Pipe, Spacers, and Seals....19
630.2.10 Blow-off Assemblies....19
630.2.11 Auto-Flushers....19
630.3 Construction....20
630.3.1 Pipe Installation....20
630.3.2 Pipe Joining....20
630.3.3 Thrust and Straddle Blocks....22
630.3.4 Connection to Existing Water System....22
630.3.5 Abandoning Facilities....23
630.4 Flushing, Hydrostatic Testing, and Disinfection....23
630.4.1 Filling and Flushing....23
630.4.2 Hydrostatic Testing....24
630.4.3 Disinfection of Pipes....26
630.4.4 Bacteriological Testing....26
Section 640 Valves and Valve Boxes....27
640.1 Design Requirements....27
640.1.1 Isolation Valve Size, Spacing, and Location....27
640.1.2 Combination Air Release Valves (CARV)....27
640.1.3 Insertable Valve....27
640.2 Materials....27
640.2.1 Gate Valves....28

640.2.2 Butterfly Valves....28
640.2.3 Valve Operator Extensions....28
640.2.4 Valve Boxes....29
640.3 Construction....29
640.3.1 Handling....29
640.3.2 Storage....30
640.3.3 Valve Installation....30
640.3.4 CARV Installation....30
640.3.5 Valve Operator Extensions....30
640.3.6 Valve Boxes....30
Section 650 Fire Hydrants....31
650.1 Design Requirements....31
650.2 Materials....31
650.3 Construction....32
650.3.1 Handling....32
650.3.2 Installation....32
650.3.3 Joints....33
650.3.4 Base Blocks....33
650.3.5 Drainage....33
650.3.6 Reflectorized Buttons....33
Section 660 Water Service Connections....34
660.1 Design Requirements....34
660.1.1 Water Services....34
660.1.2 Fire Services....35
660.1.3 Fire Flushing....35
660.2 Materials....36
660.2.1 Copper Tubing....36
660.2.2 Corporation Stops....36
660.2.3 Copper Meter Setters....36
660.2.4 Tapping Saddles....37
660.2.5 Coupling and Elbows....37
660.2.6 Repair Bands....37
660.2.7 Sample Stations....37

660.2.8 Meter Box and Covers 38
660.2.9 Water Service Valves (1-1/2-inch through 2-inch) 38
660.3 Construction 38
660.3.1 Installation of Water Meters 39
660.3.2 Service Placement 39
660.3.3 Service Taps 39
660.3.4 Small Water Services (5/8-3/4-inch through 2-inch meters) 39
660.3.5 Large Water Services (3-inch through 8-inch meters) 40
660.3.6 Service Testing and Disinfection 40
660.3.7 Fire Service Installation 40
Section 670 Precast Concrete Vaults 41
670.1 Design Requirements 41
670.2 Materials 41
670.2.1 Precast Concrete Vaults 41
670.2.2 Ladders 41
670.2.3 Sump Pumps 42
670.2.4 Vault Access Hatches 42
670.2.5 Access Manholes 43
670.2.6 Pipe Supports 43
670.3 Construction 43
Section 680 Corrosion Protection 45
680.1 Design Requirements 45
680.2 Materials 46
680.2.1 CP Test Stations 46
680.2.2 Exothermic Welding and Pin Brazing 48
680.2.3 Weld / Brazing Caps 48
680.2.4 Wire and Cable 48
680.2.5 Reference Electrodes 48
680.2.6 Galvanic Anodes 49
680.2.7 Dielectric Isolation 49
680.2.8 Wire Connectors and Splice Connections 50
680.2.9 Electrical Tapes 50
680.2.10 Conduit and Fittings 51

680.2.11 Pipe and Fittings Tape and Encasement Materials 51
680.2.12 Thin Film Coatings:....52
680.2.13 Miscellaneous: 53
680.3 Construction 53
680.3.1 CP Test Stations 53
680.3.2 Exothermic Welding and Underground Electrical Connections:....55
680.3.3 Galvanic Anode Installation 55
680.3.4 Dielectric Insulation 56
680.3.5 Polyethylene Encasement Sleeve Wrapped and Tape Wrapped:....56
680.3.6 Thin Film Coatings....57
680.3.7 Testing and Verification 58
Section 690 Cross Connection Control and Backflow Prevention 60
690.1 General 60
690.2 Installation Requirements: 60
690.2.1 Typical Conditions Requiring Backflow Protection 60
690.3 Auxiliary Water Supply: 61
690.4 Approved Backflow Prevention Assemblies and Devices, and Sizes:....61
690.4.1 Types of Assemblies and Devices....62
690.5 Testing of Backflow Prevention Assemblies: 64

Chapter 6 List of Tables

Table 630.1 – Mechanical Joint Bolt Torque....21
Table 630.2 – Required Flow and Openings to Flush Pipelines 24
Table 660.1 – Required Fire Service Flow Meter Clearance Distances....35

Section 610 – General Requirements

610.1 Scope

The following guidelines and specifications are set forth as minimum standards for the planning, design, and construction of public water system improvements. In the event these guidelines and specifications do not address a specific situation, the Public Works Department shall, at its discretion, determine the appropriate course of action to be followed. The Public Works Department may revise these requirements at any time without prior notification.

As a part of the design process for public water systems, it is highly recommended that the Engineer meet with a Public Works Department representative to review criteria and lay out the water system prior to plan submittal. It is also recommended that the Engineer meet with the City of Beaverton fire code official to ensure compliance with any applicable provisions of the Oregon Fire Code.

610.2 General Design Requirements

When designing public water system improvements, system hydraulics are to be analyzed using projections and data from the current City *Water System Master Plan* (WMP). The water system analysis shall include the fire demand and a simultaneous demand for the maximum (peak) day demand or peak hour non-fire demand, whichever is greater.

Data used to calculate available water supply for fire or non-fire demand shall be obtained from hydrant flow tests conducted by the Public Works Department. The flow test information will provide a "snap shot" of the flow and pressure measured in the water system at a given location and time. The Engineer shall recognize the actual flow and pressure available will vary depending on the time of day, water system demands, and future development. The Public Works Department recommends the Engineer include in their water system design all the safety factors identified in the flow test report. This recommendation does not relieve the Engineer of the responsibility to ensure the adequate long-term viability of any development.

The fire flow demand shall be as specified by the Fire Marshal as applicable for the location, land use type, proposed buildings, and occupancy hazard.

Required fire flow shall be determined based on the proposed building size, construction type and occupancy hazards and shall be approved by the fire code official in accordance with the 2014 Oregon Fire Code [2012 ICC International Fire Code] or current version adopted by the State of Oregon and any local amendments adopted by the City of Beaverton.

If a water system flow test and analysis is required as a condition of approval, the hydrant flow test is to be conducted by the City of Beaverton Public Works Public Works Department and analyzed by the developer's Engineer. The following steps are to be performed by the Engineer in order to obtain the flow test data and produce the water system analysis:

A. A written request for a hydrant flow test must be submitted by the applicant/engineer to the City of Beaverton Public Works staff (phone 503-526-2220) (https://www.beavertonoregon.gov/174/Public-Works). Allow seven (7) to ten (10) working days for flow test results, unless an Extended 7-day Static Hydrant Pressure Logging (ESHPL) is requested. Allow an additional seven (7) calendar days for results if the ESHPL is requested.

B. Two stamped copies of the design calculations and other relevant documentation, including all assumptions and hydrant flow test results, are to be provided by a registered professional engineer to the City Building and Tualatin Valley Fire and Rescue (TVFR) for review and evaluation.

610.2.1 Public Water Easement

All water infrastructure is to be located within a dedicated public right-of-way. When it is not practical or possible, or a situation exists where the Public Works Department requires the improvements to be placed outside of site right-of-way, an easement shall be provided. The minimum water main easement shall be 15 feet wide (when placed in a roadway or parking area) and a minimum 20 feet wide if vehicular access is not normally available.

The easement shall be exclusive for water mains and appurtenances and not shared with other utilities or structures (unless otherwise approved by the Public Works Department). The easement shall allow the City to construct, inspect, operate, maintain, replace, reconstruct, or remove the water distribution system. Water services or facilities located on private property shall be in a recorded easement measuring 5 feet to 10 feet from each outside wall of the meter vault or box, depending on water service size. Easement shall be titled "PUBLIC WATER EASEMENT".

Meter boxes or other public water infrastructure shall not be located in a Public Utility Easement (PUE).

All easements shall be recorded prior to City acceptance.

See Subsection 130 "Easements" for additional information and requirements.

610.3 General Material Requirements

All materials shall be new and undamaged. No rebuilt, reconditioned, or used material will be allowed. Any internal or external imperfections found with the product must be returned to the manufacture and replaced.

The same manufacturer of each item shall be used throughout the project.

All materials not specifically referenced shall comply with applicable sections of ANSI, ASTM, or the AWWA Standard Specifications with review approval from the Public Works Department.

See City of Beaverton Public Works Department Approved Product List, located on the City of Beaverton website.

610.4 General Construction Requirements

Improvements shall be constructed as shown on the plans and in accordance with the Engineering Design Manual and Standard Drawings. Equipment and materials shall be installed in compliance with the manufacturer's recommendations, except where a higher quality of workmanship is required by the Plan Specifications and these Standards.

All materials and work shall be in strict accordance with any applicable regulations and requirements of Federal, State, and local authorities. The Contractor may be required to arrange for inspection by these agencies and submit evidence of their approval, when required or requested by the Public Works Department.

Take care to prevent damage to pipe, fittings, and other materials and equipment during transportation, unloading, and final placement for installation. Manufacturer recommended product handling shall be followed to protect

coatings, linings, and structural integrity of materials used in public water system construction. Provide and install a cap or plug on each end of pipe during transportation and onsite storage to protect linings and coatings from debris. Install water tight plug in end of installed pipe at the end of the work day. Under no circumstances shall materials be dropped or dumped into the trench.

All damaged materials and equipment during construction shall be replaced or repaired to the satisfaction of the Public Works Department.

The Contractor shall maintain safe working conditions for employees, City staff, and the general public in and around trench excavations. Precautions shall be taken to avoid damage to franchise utilities, adjacent properties, existing water infrastructure, and public or private landscapes/hardscapes. If any underground utilities are damaged, report damage to Public Works Department Operations and Maintenance.

610.4.1 Maintaining Existing Service

It is required to maintain continuous water service to existing water users at all times. The Contractor shall schedule construction work accordingly. When it becomes necessary to shut down service to make required inter-ties or repairs, the Contractor shall notify and get shut-off date approval from the Public Works Department so affected customers can be notified within 48 hours.

If a fire system is affected, the Contractor is required to contact the approved fire code official for alternate fire protection requirements.

610.4.2 Non-Emergency Water Shut-off Notification

Water main and service shut-offs are to be coordinated through a Public Works Department representative. Customers are required to be notified a minimum of 48-hours prior for residential properties and 72-hours for commercial or industrial properties.

610.4.3 Bulk Water

Water will be available for the Contractor's use from approved fire hydrants upon purchase of a Bulk Water Permit from the Public Works Department. Site specific hydrants for Bulk Water usage may be allowed on a case-by-case basis, at the sole discretion of the Public Works Department. The Contractor or developer shall submit a written request and description to the Public Works Department, including: project name, location, storage and delivery methods, and reason for request.

All bulk water usage shall be metered and include an approved backflow assembly when required. Bulk Water meters are supplied by the Public Works Department with the permit.

610.4.4 Valve Operation

No Beaverton water system valves within the City's water service area shall be operated **without authorization by the DRC**. Prior approval must be granted by the DRC for any plan for valve turning, shutdown, improvement, or repair to be performed on City's water system. Valves on existing waterline mains and distribution lines shall only be operated by Public Works Water Operations personnel under the direction of the DRC (or designee).

610.4.5 Staking Requirements

Construction staking is required for all water system improvements. Staking shall be performed by or under the supervision of an Oregon Registered Professional Land Surveyor or Registered Professional Engineer.

Staking shall be in place prior to installation of water system improvements. Staking shall be preserved and shall not be disturbed until the Construction Inspector authorizes it to be removed. If staking is disturbed or removed prior to the Inspector's approval, it shall be promptly replaced.

Line and grade stakes for water mains shall be provided on an offset line at intervals not exceeding 50 feet. Offset distances shall not be greater than 20 feet. Stakes shall be marked with stationing as well as hub elevations and elevation references (cut/fill) to finished grade, i.e., and/or to top of pipe.

Locations of taps, valves, fittings, hydrants, water meters, and other appurtenances shall be stake with offset stakes. Hydrant and meter stakes shall be marked with elevation references (cut/fill) to top of curb or to finished grade if no curb will be installed. Meter stakes shall be marked with lot numbers.

At the end of each project all survey staking material must be removed from site before being declared complete.

Section 620 Trenching, Backfill, and Surface Restoration

620.1 Design Requirements

620.1.1 Erosion/Sediment Control

An erosion control plan shall be designed and approved for all water related projects. Requirements for design of the plan shall conform to the latest version of the Clean Water Service Design and Construction Standards.

620.2 Materials

620.2.1 Foundation Stabilization Materials

2" to 3" dense graded crushed rock meeting ODOT/APWA Standard Specifications Section 00641, Section 02630, and is approved by the Public Works Department.

Geotextile fabric is to meet ODOT/APWA Standard Specification Table 02320-1 (Drainage) for Type 2 geotextiles.

620.2.2 Bedding and Pipe Zone Materials

Class "B"

¾"-0" dense graded crushed rock, with no more than 5% passing the No.200 sieve (wet test) and meeting ODOT/APWA Standard Specification Section 00641 and Section 02630.

Class "E"

Controlled Low-Strength Material (CLSM) conforming to ODOT/APWA Standard Specifications Section 00442. All CLSM mix designs are to be submitted for approval and must include 28 day cylinder break report from test batch as evidence of compressive strength, not exceeding 150 psi.

620.2.3 Backfill Materials

Class "B"

¾"-0" dense graded crushed rock, with no more than 5% passing the No.200 sieve (wet test) and meeting ODOT/APWA Standard Specifications Section 00641 and Section 02630.

Class "A"

Clean native or imported earth material free of organics, rock, stones, wood, and other debris.

620.3 Construction

620.3.1 Excavation

The Contractor is to provide all materials, labor, and equipment necessary to protect trench excavations at all times.

Excavations within the public right-of-way are required to be backfilled by the end of the work shifts, unless another method for safely covering the excavation is approved by the Public Works Department.

Disposal of all excavated materials shall be at an approved permitted dumpsite meeting all State and local requirements.

620.3.2 Trenching Requirements

The allowable open trench length is typically 100 feet with the public right of way. This distance may be reduced within public right-of-way areas based on safety concerns, work conditions, vehicle access, or lack of Contractor resources for trench area management.

The minimum trench width allowed for a mainline is 24 inches and increases based on the pipe diameter. Consideration shall be taken to ensure trench is wide enough to accommodate shoring, protective structures, pipe installation, backfilling and compaction.

The Contractor shall provide means and equipment for trench dewatering during all construction. Water shall be disposed of in an approved manner to reduce impact and prevent all facility and property damage. Water discharge shall meet the requirements of the Clean Water Services (CWS) "Erosion Prevention and Sediment Control Planning and Design Manual".

Related Standard Drawings: 620-1

620.3.3 Pipe Bedding and Trench Backfill

Compaction of trench backfill materials shall be according to Oregon Standard Specifications for Construction Section 00330.43a, b, and c.

Foundation Stabilization Material Placement

If the material at the bottom of an excavation is deemed by the Public Works Department as unsuitable for support, the Contractor shall over excavate as directed and replace with foundation drain rock with gradation as requested by the Engineer. Foundation stabilization material shall be placed in 6-inch lifts and compacted up to the required grade.

Geotextile fabric may be approved for use in place of or in addition to over excavation and stabilization rock. A registered Geotechnical Engineer must be consulted if deemed necessary by the Public Works Department.

Pipe Bedding Placement

Place pipe bedding material to a minimum thickness of 4 inches below the outside bottom of the pipe barrel then spread smoothly to the proper grade so that the pipe is uniformly supported along the entire barrel length.

Excavate bell holes for each joint to permit proper assembly and inspection.

Pipe Zone Material

Place material in loose lifts, not exceeding 6 inches, compacting by hand under the haunches of the pipe and in areas not accessible to mechanical tampers. Bring lifts up evenly to a minimum of 8 inches above the top of pipe.

Trench Backfill

Backfill the trench in loose lifts of 12 inches to 24 inches maximum depending on compaction method. Compact material to a minimum 95% of maximum density as determined by AASHTO T-99.

Water settling methods are not allowed.

CLSM (CDF) Backfill

Discharge CLSM material from the mixing truck into the trench in a way that prevents dislodging or the shifting of water mains or other infrastructure from intended elevation and alignment. This may require multiple pours to accomplish, especially if buoyancy is a factor. The flowability (slump) shall be adjusted, as needed, to guarantee all voids within the trench are filled as required.

CLSM is not to be placed in temperatures 38° F or less, or poured on frozen ground.

Use sandbags, wood forms, or other barriers to contain CLSM mix as needed. Such barriers may require removal before burial. Properly seal and protect culverts, pipelines and other effected utilities from CLSM infiltration.

All ground and surface water in the trench shall be controlled during placement of CLSM. At no time will CLSM be allowed to be poured in submerged conditions.

Allow CLSM to firmly set prior to placement of additional lifts. To prevent rutting and displacement CLSM shall set a minimum of 24 hours before traffic or construction equipment come into contact with the material. In roadway areas where traffic will need to be restored at the end of the work shift, steel sheeting shall be used until CLSM has hardened and road surface has been rebuilt.

CLSM shall be designed to a maximum of 150 psi. Test cylinders shall be prepared according to ASTM D-4832. Field testing of CLSM shall include one (1) set of four (4) 3” x 6” cylinders. Two (2) cylinders are for break at 7 day and two (2) for break at 28 day.

Related Standard Drawings: 620-1

620.3.4 Compaction Testing

For quality control, a third party ODOT/APWA certified testing company shall be contracted to perform nuclear density testing and any other applicable testing. Compaction test requirements shall be in accordance with ASTM D698.

A standard proctor is to be obtained through an approved certified testing laboratory for all materials used by the Contractor.
Generally, tests are to be performed one (1) every 100 feet of linear trench for pipeline trenches, and minimum one (1) test for each water service or other lateral appurtenance trench. Trenches 5 feet deep and greater will require compaction testing every 2 feet of depth. Frequency of in field testing will be determined by excavation type, depth of excavation, and the Contractor’s compaction methods and equipment.

If trench backfill does not pass compaction testing it shall be evaluated for deficiencies, such as inadequate moisture, material inconsistencies, and contamination. The Contractor shall discuss a plan for correcting these deficiencies by means of increased compaction effort, addition of water, or the removal and replacement of backfill material. Plan must be approved by the Public Works Department.

Trench backfill within an existing roadway is to be visually tested for soft spots at finish grade of the rock subgrade, according to ODOT/APWA TM 158 in ODOT/APWA Manual of Field Test Procedures.

Section 630 Water Main Piping

630.1 Design Requirements

630.1.1 Pipe Sizes

All hydraulic calculations to determine pipeline sizing are to be made using Hazen-Williams "C" coefficient of 100 and velocity not exceeding 5 fps. The following pipe sizes are accepted for use in the Beaverton water system: 4, 6, 8, 12, 16, and 24-inch. Distribution water mains typically have a minimum 8-inch diameter.

Water piping serving dead-end streets may be reduced in size below 8 inches if all of the following conditions apply to the waterline:

It has no more than five (5) service connections.

There is no possibility for future extension.

Design is accompanied by hydraulic calculations validating that the minimum fire flow required by the fire code official can be met.

The Engineer is encouraged to meet with a Public Works Department representative prior to design to discuss the size of water mains and any other matters particular to the project. Pipeline size shall be determined based on service area and system requirements, or as established in the current City WMP.

630.1.2 Pipe Location

Water mains within the public right of way along looped or curved streets shall not switch sides and be located on either the inside or outside of the loop.

Related Standard Drawings: 630-1

630.1.3 Pipe Depth

Minimum required cover over water main piping in unimproved areas is 48-inches.

Minimum required cover over water mains in improved areas is:

- 36-inches for piping 12-inches and smaller
- 48-inches for piping 16-inches and larger

Care shall be taken to maintain the required cover depth over water system piping and appurtenances in all easement areas.

630.1.4 Pipe Deflection

Location and degree of deflection at joints shall be shown on plans for all vertical and/or horizontal pipe deflection. See Subsection 630.3.2. "Pipe Joining".

630.1.5 Clearances from Other Utilities

All clearances listed below are measured from the edge of each pipe and/or utility.

Water services and sewer laterals shall have a 5-foot minimum horizontal separation.

Maintain minimum vertical and horizontal clearances. Avoid crossing at highly acute angles.

Horizontal clearances from water piping and appurtenances:

Cable TV	5’
Natural Gas	5’
Electrical	5’
Storm Sewer	5’
Sanitary Sewer	10’ or as allowed by OAR 333-061-0050
Telephone, Fiber Optics	5’
Other (not specified)	5’ or as required by the Public Works Department

Vertical clearances from water piping and appurtenances (for crossing only):

Cable TV	12”
Natural Gas	12”
Electrical	12”
Storm Sewer	12”
Sanitary Sewer	18” or as allowed by OAR 33-061-0050
Telephone Fiber Optics	12”
Other (not specified)	12” or as required by the Public Works Department

All utilities shall cross under water piping and appurtenances unless otherwise authorized by the City Engineer.

Where a water pipe crosses below a sanitary sewer line, one full length of water pipe shall be used with the pipe centered for maximum joint separation. Spacing and separation may be modified as allowed by OAR 333-061-0050 and approved by the City Engineer.

630.1.6 Pipeline Extensions

If the need for an extension of public water system results from property development, the extension shall be at the expense of the owner(s) of the parcel(s) for which the extension is necessary. The condition is applicable to the full length of all street frontages.

Water systems shall be installed through new development or improvements to existing infrastructure. Water system improvements shall take into consideration future development and effects to adjacent and downstream properties.

630.1.7 Dead-End Mains

Dead-end waterlines shall be avoided whenever possible. Considerations for allowances of dead-end water mains are: future development, cul-de-sacs, or when the looping of the water system or banking of water meters is not practical.

A line size valve shall be installed on all dead-end water mains where future extensions are probable. Dead-end water mains shall terminate prior to property boundary and be equipped with a blow-off assembly.

630.1.8 Blow-off Assemblies

Blow-off assemblies shall be required on all dead-end water mains for flushing, disinfection, and operational flushing necessary for maintaining water quality. For blow-off sizing requirements refer to the flow chart in Subsection 630.4.1. “Filling and Flushing”.

630.1.9 Auto-Flushers

An auto-flusher may be required for maintaining water quality on dead-end water mains and large water mains designed for future water supply needs. The projected usage necessary for meeting the Oregon Health Authority minimum standards for safe drinking water will be evaluated in determining auto-flusher requirements.

Proper drainage shall be considered when planning installation of an auto-flusher. If installed within 1000 feet of a waterway or designated wetland, water shall discharge into a public sanitary or storm sewer, unless otherwise approved by the Public Works Department.

630.2 Materials

630.2.1 Ductile Iron Pipes

Ductile iron pipe shall be Class 52 thickness, conforming to the latest revision of ANSI/AWWA C151/A21.51.

An Affidavit shall be provided with each shipment stating the ductile iron pipe was cast from a domestic raw material source consisting of at least 75% recycled ferrous metals. The Affidavit shall be signed by a Professional Engineer registered in the state of the source manufacturing facility.

All ductile iron pipes shall be factory cement-lined and seal-coated conforming to ANSI/AWWA C104/A21.4.

The exterior of the ductile iron pipe shall be coated with a layer of arc-applied or paint-applied zinc coating per ISO 8179. The mass of the zinc shall be 200 g/m2 of the pipe surface area. The outside coating of the pipe shall consist of an asphaltic seal coat approximately 1 mil thick conforming to ANSI/AWWA C151/A21.51. Pipe markings shall

include the word "Zinc" in the pipe markings or label required by AWWA C-151 and/or other markings as deemed appropriate by the manufacturer.

Pipe shall be furnished in 18-foot or 20-foot lengths.

All ductile iron pipe shall be sourced and manufactured in the United States of America. No exceptions will be allowed.

630.2.2 Push-on Joints

All push-on gaskets shall be restraining gaskets designed for use in either Fastite or Tyton joint manufactured pipe. Push-on gaskets shall conform to ANSI/AWWA C11/A21.11. Gaskets for pipe sizes 4-inch to 12-inch shall be rated for 350 psi. Gaskets for 18-inch to 24-inch pipes shall be rated for 250 psi.

630.2.3 Ductile Iron Fittings

All ductile iron fittings shall be manufactured in the United States of America. Any exceptions shall require prior written approval from the City Engineer.

All fittings shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C153/A21.53. Fittings shall have cast upon them the manufacturer's identification, pressure rating, nominal diameters of openings, and the number of degrees or fractions of a circle for all bends.

The exterior of the ductile iron fittings shall be coated with a layer of arc-applied or paint-applied zinc coating per ISO 8179. The mass of the zinc shall be 200 g/m2 of the pipe surface area. The outside coating of the pipe shall consist of an asphaltic seal coat approximately 1 mil thick conforming to ANSI/AWWA C151/A21.51. Fitting markings shall include the word "Zinc" in the fitting markings or label required by AWWA C-151 and/or other markings as deemed appropriate by the manufacturer.

Fittings shall be coated inside with an approved epoxy or cement mortar with an asphaltic seal coat conforming to AWWA C104. Fittings shall be coated outside with an approved epoxy or a bituminous coating at least 1 mil thick, as specified in Section 4.4 of AWWA C110.

Fittings shall be ductile iron mechanical joint (MJ) or flange joint (FLG) conforming to AWWA C153 and C110.

Specialized fittings may be required by the Public Works Department when involving bridge infrastructure, casing pipe or pipes with high vibration exposure.

630.2.4 Mechanical Joint Fittings and Restraints

All mechanical joint fittings shall include mechanical restraints. All mechanical restraints shall be manufactured in the United States of America. Any exceptions shall require prior written approval from the City Engineer.

Ductile iron mechanical joint fittings and accessories shall conform to ANSI/AWWA C11/A21.11, ANSI/AWWA C110/21.20, and ANSI/AWWA C153/A21.53. Fittings for pipe sizes 4-inch to 24-inch shall be rated for 350 psi working pressure.

Bolts and nuts shall be domestic Cor-Blue, or approved equal, T-head bolts and nuts, constructed from corrosion-resistant, high-strength low-alloy steel that conforms to ANSI/AWWA C111/A21.11 and coated with a ceramic-filled

fluorocarbon resin that can hold up in highly corrosive soil conditions. Mechanical joint restraints shall be an integral part of the follower gland. Restraint shall be provided by individually activated wedges that increase resistance to pullout as the force of pressure is increased. Joint restraint ring and wedge components shall be constructed of grade 60-42-10 ductile iron, conforming at ASTM A536. Wedges shall be heat-treated to a minimum hardness of 370 BHM. The dimensions of the follower gland shall be compatible with joint bells conforming to ANSI/AWWA A21.10/C110 and ANSI/AWWA A21.52/C153. Mechanical restraint systems shall be pressure rated to a minimum 350 psi for sizes up to 16-inch and 250 psi for pipe sizes 18-inch and larger.

630.2.5 Flange Joints

Flange fittings are allowed only where shown on the Standard Drawings, or as approved by the City Engineer.

Flange bolt holes and pattern shall conform to ANSI B16.1 for class 125 flanges or ANSI B16.5 for class 150 flanges. Class 250 flanges are not compatible with classes 135 and 150 bolt pattern.

Bolts for flanged joints shall be the size and quantity shown on Table 14 of AWWA C110. Flange bolts and nuts shall be domestic Cor-Blue, or approved equal, constructed from corrosion-resistant, high-strength low-alloy steel that conforms to ANSI/AWWA C111/A21.11 and coated with a ceramic-filled fluorocarbon resin that can hold up in highly corrosive soil conditions. Bolt and nut threads shall conform with ASME B1.1.

Flange joints are to have a minimum pressure rating of 250 psi.

630.2.6 Restrained Flange Coupling Adaptors/Dismantling Joints

Gland and flange body shall be ductile iron per ASTM A536, grade 65-45-12, and compatible with ANSI class 125 and 150 bolt circles.

T-Bolts and nuts shall be domestic Cor-Blue, or approved equal, constructed from corrosion-resistant, high-strength low-alloy steel that conforms to ANSI/AWWA C111/A21.11 and coated with a ceramic-filled fluorocarbon resin that can hold up in highly corrosive soil conditions.

Gasket materials shall conform to ASTM D20.

630.2.7 Tapping Sleeves

Tapping sleeves shall conform to ANSI/AWWA C223 unless otherwise specified.

The tapping sleeve body and flange shall be double strap stainless steel Type 304, conforming to ASTM A240. Flange class shall conform to Subsection 630.2.5 “Flanged Joints” and accommodate tapping flanges per MSS SP-60.

Gaskets shall seal the full circumference of the pipe conforming to ASTM D2000.

Bolts and hardware shall be stainless steel Type 304 and be coated to reduce galling.

Tapping sleeves shall be equipped with a ¾-inch NPT brass or stainless steel test plug for seal testing prior to tapping.

Related Standard Drawings: 630-2

630.2.8 Polyethylene Encasement

Polyethylene Encasement shall be installed on all DI pipe and fittings. Provide V-Bio Enhanced Polyethylene Encasement of not less the 8 mils thickness. Encasement be installed in accordance with AWWA C600 and ANSI/AWWA C195/A21.5 and recommendations of the AWWA M41 *Manual of Water Supply Practice – Ductile Iron Pipe and Fittings.* Specifically, the wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe and any wrap at tap location shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

630.2.9 Casing Pipe, Spacers, and Seals

Casing pipe shall be smooth steel conforming to ASTM A36. The minimum wall thickness shall be as required by the jurisdiction governing the highway, railway, or waterway crossed. Casing pipe shall not have a wall thickness less than ¼-inch.

Casing spacers shall be used to support the carrier pipe within the casing and help resist movement of the pipeline. Casing spacers and hardware shall be manufactured from stainless steel, be of 2-piece construction, and a minimum 12 inches wide.

Skids are to be manufactured out of polyethylene for insulation and abrasion resistance.

The spacer shall have a minimum of four (4) runners for carrier pipe sizes up to 12-inch, and six (6) runners for carrier pipe sizes through 24-inch.

Casing seals are to be either a slip-on boot style or split wrap-around style. Slip-on boot style seals are to be manufactured out of 1/8-inch synthetic neoprene rubber and be secured by two (2) stainless steel bands and clamps. Split wrap-around style seals are to be manufactured from 1/8-inch flexible coal tar, reinforced with fiberglass and include two (2) stainless steel bands and clamps.

630.2.10 Blow-off Assemblies

2-inch Blow-off Assembly (Permanent)

The blow-off assembly shall be self-draining, non-freeze type.

Design of the blow-off shall allow for repair and maintenance work to be performed without excavation. The size of the device shall allow for installation within a “Vancouver” style valve box. See Subsection 640.3.7 “Valve Boxes”.

The inlet and outlet connections and all internal working parts of the assembly shall be constructed of brass. Inlet shall be a vertical 2-inch female iron pipe thread connection. The outlet shall be a male iron pipe thread connection.

Pipe and fittings between the ductile main and the blow-off assembly shall be 2-inch brass on copper. All piping, fittings, and meter stops shall meet requirements of Section 660 “Water Service Connections”.

4-inch Blow-off Assembly (Temporary)

All pipe and fittings are to meet requirements of this Subsection. The 4-inch gate valve must meet requirements of Subsection 640.2.1. “Gate Valves”.

Related Standard Drawings: 630-3, 630-4, 630-5

630.2.11 Auto-Flushers

Auto-flusher assembly inlets shall be either FIPT or MIPT connection manufacture from brass or stainless steel.

Piping and electronics are to be rated at 150 psi or greater.

Piping for auto-flushers is to be 2-inch type K rigid copper with an isolation valve located at the water main.

Device controller is to be stand-alone 9 volt DC powered, programmable for up to 12 flushing cycles per day.

Related Standard Drawings: 630-6, 630-7

630.3 Construction

If a project contains multiple connection points to the City's existing water system, only one connection will be allowed until all testing, disinfection, and acceptance of water improvements has been completed to the satisfaction of the Public Works Department DRC. The Contractor is to install a temporary blow-off at the end of each leg prior to the tie-in point to allow for flushing of the system. Maintain minimum / maximum utility clearance as identified in section 630.1.5.

Proper equipment, tools, and facilities shall be provided and used by the Contractor for the safe and convenient execution of the work.

630.3.1 Pipe Installation

All pipe and appurtenances shall be installed at the location, elevation, and grade shown on the plans, or as directed by the Public Works Department. At no time shall the water line deviate more than 1-inch vertically or horizontally from the approved design, without prior approval from the Public Works Department.

Pipe configuration shall be with the bell pointed in direction of installation whenever practical.

Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed. During installation no debris, tools, clothing, or other materials shall be placed in the pipe. When pipe installation is not in progress, the ends of the pipe shall be closed by a watertight plug or equivalent mechanical means.

Full lengths of pipe shall be used whenever possible to limit the number of joints. Pipe lengths less than 2 feet shall not be used unless approved by the Public Works Department.

The cutting of pipe must be executed in a neat manner without damage to the pipe or the lining. Cuts shall be smooth, straight, and at right angles to the pipe axis. After cutting, the pipe ends shall be dressed with a file or power grinder to remove all rough and sharp edges. Cut ends of push-on joint pipe shall be suitably beveled. Approved cutting equipment includes abrasive cut-off saw, rotary wheel cutter, a guillotine pipe saw, or milling wheel saw.

630.3.2 Pipe Joining

Cleaning

Before joining, all pipe contact surfaces are to be thoroughly cleaned and kept clean until joining is completed. Remove all lumps, blisters, and excess asphaltic tar coating from the bell and spigot ends of each pipe and fitting.

Mechanical Joints

All mechanical joints shall be installed with joint restraints.

Installation of mechanical joints shall be as recommended by the manufacturer and in accordance with ANSI/AWWA C111/A21.11 Appendix A. If effective sealing is not obtained, the joint shall be disassembled, thoroughly cleaned, and reassembled.

Bolts shall be uniformly tightened to the torque valves listed below or according to manufacturer's instructions, whichever is greater.

Table 630.1 – Mechanical Joint Bolt Torque

Joint Size (in.)	Bolt Size (in.)	Range of Torque (ft-lbs)
3	5/8	45-60
4-24	¾	75-90
30-36	1	100-120
42-48	1¼	120-150

The above torque loads may be applied with torque measuring or indicating wrenches.

If effective sealing is not attained by the maximum torque indicated above, disassemble the joint and reassemble after thorough cleaning. Overstressing of bolts to compensate for poor installation is not permitted.

Push-on Joints

All push-on joints shall be restrained.

Installation of push-on joints shall be according to manufacturer's recommendations and AWWA C600.

All joint surfaces shall be lubricated immediately before joining of pipe with an NSF-61 approved joint lubricant, as recommended by the gasket manufacturer.

The Contractor shall take precaution not to damage the pipe, gasket, or fittings when pushing pipe together. Pipe spigot is to be squared with pipe bell prior to the joining process. If deflection is needed at a push-on joint, deflection shall take place after pipe is shoved home in the bell.

Deflection

Pipe deflection shall not exceed 80% of the manufacture's maximum allowable pipe joint deflection.

Flange Joints

Installation of flange joints shall be according to manufacturer's recommendations and ANSI/AWWA C111/A21.11 Appendix C.

Flange faces shall be flat and perpendicular to the pipe center line. Flange bolts shall be tightened in a progressively crisscross pattern, such as by first tightening the bottom bolt; then the top bolt; next the bolts on either side; finally, the remaining bolts. This process should be repeated until all bolts are sufficiently tightened. Bolts for flange fittings shall be long enough to tighten through the nut and have three threads exposed beyond the nut.

630.3.3 Thrust and Straddle Blocks

The Public Works Department will only accept concrete thrust blocking where shown on Standard Drawings or for applications where joint restraints are not feasible. Cost is not a determining factor in feasibility.

When permitted, install thrust blocking according to the Standard Drawings. Concrete shall have a slump of 2 to 4 inches and shall comply with ODOT/APWA Standard Specifications Section 2001.29 (Class 3000 – ¾-inch) "Commercial Grade Concrete". Any field mixing of concrete must be a 5000 psi mix and approved by the DRC.

Concrete blocking shall extend from the fitting to solid undisturbed earth and installed so that all joints are accessible for repair. Prior to using high-early concrete for thrust blocking, the Contractor shall submit a mix design from the supplying concrete plant for Public Works Department approval.

Concrete thrust restraint for vertical bends shall include embedded steel rebar hooks as shown in the Standard Drawings.

All pipe and fittings in contact with concrete shall be completely wrapped in two (2) layers of 4-mil polyethylene sheets or one (1) layer of 8-mil polyethylene prior to the placement of the concrete.

Straddle blocks installed on existing waterlines 8-inch and smaller require U.G. clamps or mid span restraint glands. Straddle blocks on waterlines 10 inches and larger require designed rebar reinforcement stamped by a registered professional engineer and approved by the Public Works Department.

Related Standard Drawings: 630-8, 630-9

630.3.4 Connection to Existing Water System

Connections to the existing water system shall be made at a time and under conditions which minimize service interruption to customers, as authorized by the Public Works Department DRC. See Subsection 610.4.2. "Non-Emergency Water Shut-off Notification".

Facilities shall be provided for the proper dewatering and disposal of all water removed from water mains and excavations to avoid damage to adjacent property.

Connection to an existing water system shall only take place after the new improvements are leak tested, flushed, disinfected, and satisfactory bacteriological test results are obtained. All connections to the existing water system shall be authorized by and executed in the presence of the DRC (or designee).

Special care shall be taken to prevent contamination while dewatering, cutting into, and making connections with existing water pipe. Trench water, mud, or other contaminating substances shall not be permitted to enter the water pipes. The interior of all pipe, fittings, and valves installed in water connections shall be thoroughly cleaned and then swabbed, sprayed, or dipped in a 1% hypochlorite solution prior to assembly.

Hot Tapping

Connection to existing water pipe may be made by means of a hot tap. The cutting in of tees will not be permitted unless approved and signed off by the Public Works Department Engineering Manager.

All hot taps shall be installed by a contractor approved by the Public Works Department and installed under the direction of Public Works Department representative. Contact the Public Works Department for a list of approved tapping contractors.

Hot taps 10 inches and larger require a horizontally installed gate valve with bevel gear actuator, unless bury depth allows for a minimum 24 inches of cover over valve nut.

Connection to Existing Valves

Water improvements that include connection to the City water system by means of an older existing valve may require the replacement of said valve if the valve's condition is determined by the Public Works Department to be questionable in performing the necessary pressure testing and disinfection.

630.3.5 Abandoning Facilities

The Contactor shall seal the open ends of all pipes, fittings, etc. that are to be abandoned with an end cap, coupling, or a concrete plug with a thickness equal to the diameter of the pipe. The Public Works Department requires that all abandoned piping be severed as close to active piping as practical.

All service lines are required to be severed at the main and for the corporation stops to be capped if not required to be removed. A 4" diameter by 4" long piece of PVC pipe is to be installed over all capped corporation stops that remain as part of abandonment. All other parts of the service lines and other appurtenances are to be cut off and removed at 24 inches minimum below finish grade.

Structures (vaults, meter boxes, etc.) shall be removed completely to eliminate conflict with any future utility improvements. Abandonment of structures shall be completed only after piped systems have been properly abandoned.

Abandoned valve boxes in pavement areas shall be cut off 24 inches below grade, removed, gravel filled, and plugged with compacted asphalt. Valve boxes outside of pavement areas shall be cut off 24 inches below grade, removed, and filled with native backfill.

The Public Works Department has first claim to any removed or abandoned water materials (valves, hydrants, fittings, etc.). The Contractor shall dispose of all unwanted materials in an approved manner.

630.4 Flushing, Hydrostatic Testing, and Disinfection

630.4.1 Filling and Flushing

Filling

At the completion of water improvements, the water main shall be slowly filled while removing air through air release valves, hydrants, blow-offs, and water services.

Flushing

Prior to disinfection of water improvements, all water mains, services, and appurtenances shall be flushed to remove all trapped air and any foreign material or debris which may remain in the pipelines following installation.

The Contractor shall provide hoses and temporary pipes as required to dispose of flushed water into a storm sewer system. The Contractor shall make provisions to dechlorinate the flushed water as required.

Flushing velocities shall be a minimum 3-fps for water mains 12-inch and smaller. For water mains larger than 12-inch, where it is impractical or impossible to flush the pipe at a velocity of 3 fps, the flushing procedure shall be reviewed by Public Works Department staff.

Water for Filling and Flushing

The Public Works Department will furnish all water necessary for initial testing, flushing, and disinfection. If additional water is needed due to unsatisfactory tests, the Contractor will be billed for the water used.

Water needed for other construction activities shall be obtained as described in Subsection 610.4.3. "Bulk Water".

Table 630.2 – Required Flow and Openings to Flush Pipelines

40 psi Residual Pressure in Water Main

Pipe Diameter	Flow Required to Produce 3 ft/s (approx.) Velocity in Main	Size of Tap, in.(blow-off)				Number of Hydrant Outlets	
		1"	1 ½"	2"	4"		
Inches:	GPM:	Number of Taps in Pipe				2½"	4½"
4	120	1	-	-	-	1	1
6	260	-	1	-	-	1	1
8	470	-	2	-	-	1	1
12	1060	-	-	3	-	2	1

With 40-psi pressure in the main with the hydrant flowing to atmosphere, a 2½-inch hydrant outlet will discharge approximately 1,000 gpm; and a 4½-inch hydrant outlet will discharge approximately 2,500 gpm. Number of taps on pipe based on discharge through 5 feet of galvanized iron (GI) pipe with one 90° elbow. Data conforming with ANSI/AWWA C651 Table 3.

630.4.2 Hydrostatic Testing

Prior to hydrostatic testing, all water improvements shall be completed including water mains, services, blow-offs, and any other appurtenances.

The Contractor shall perform hydrostatic (pressure) and leakage tests on all newly laid pipes and valves in accordance with OAR 333-061-0050, the latest methods outlined in AWWA C600, and these Standards.

The Public Works Department Engineer or Inspector shall be notified a minimum of 24 hours prior to testing, and shall be present to monitor all tests.

The Contractor shall furnish all necessary equipment, material, and labor required to conduct the testing.

Provide the following equipment and materials for hydrostatic testing:

A clean 55-gallon barrel and 5-gallon bucket.

One injection pump approved by the Public Works Department.

Suitable hose and any additional equipment necessary to perform the testing correctly.*

*The Public Works Department will provide a NIST calibrated pressure gauge for final hydrostatic testing.

The test shall be conducted after the trench has been partially backfilled with the joints left exposed for inspection, or completely backfilled and compacted. Where a section of pipe is to be tested with newly poured concrete thrust blocking, the Contractor shall not apply test pressure until a minimum of **seventy-two (72) hours** have elapsed after the concrete was installed. Any deviation shall be reviewed by the Public Works Department staff.

The following procedure shall be used to conduct a pressure test, unless otherwise approved by the Public Works Department.

Note: The Public Works Department does not guarantee existing water system valves against leakage. The Contractor is advised to test new improvements independent of the existing water system:

1. The pipe shall be filled with water using an approved method that protects the existing distribution system from contamination. The new piping being tested shall remain isolated from the existing water system.

2. After the trench has been backfilled or partially backfilled, slowly fill the pipe with water, expelling all air during the filling.

3. The test pressure shall be a minimum of 150 psi or 1.5 x the main pressure, whichever is greater, for the 1-hour test.

4. Apply the specified test pressure by pumping additional water into the new piping system with a hydrostatic pump.

5. Valve off the pump and hold the pressure in the line for the 1-hour test period. If the pressure falls below the minimum psi listed in iii, the line shall be pumped back up to the minimum pressure. The amount of water used to re-obtain minimum pressure shall be measured and counted against the leakage.

6. At the end of the test period, again operate the pump until the minimum test pressure is obtained, measuring the water used.

7. The pump suction shall be in a barrel or similar container, or metered so that the amount of water required to restore the test pressure may be measured accurately.

Leakage shall be defined as the quantity of water necessary to restore the specified test pressure at the end of the test period. No pipe installation will be accepted if any leakage is a result of the test. Should any section of pipe being tested account for leakage, the Contractor shall locate and repair the defective joints, pipe, or appurtenances and retest that section of pipe. The Leakage tests must be approved by the DRC prior to disinfection.

At the satisfactory completion of Hydrostatic testing, all line valves are to be tested to assure effective seal and proper operation. While under full test pressure, start with the furthest valve from the test gauge and test each valve in succession up to, and including, the closest valve. The testing procedure is to close the valve being tested and release pressure beyond. Valves are considered acceptable when no loss is observed on the test gauge.

630.4.3 Disinfection of Pipes

Disinfection of water improvements shall be done in accordance with all Oregon Health Authority regulations and AWWA C651 Standards.

Methods

Methodology must be reviewed and approved by the DRC prior to disinfection procedures.

Procedure

The Contractor shall schedule disinfection no later in the week than Wednesday, to allow for completion of bacteriological sampling on Friday.

Disposal of Disinfection Water

Dispose of the chlorine water mixture in an approved manner. Methods of disposal shall be as follows:

1. Discharge water into a sanitary sewer system: The Contractor shall provide all hoses, fittings, and temporary pipes required to discharge into an approved public sanitary system. All hoses and piping shall be tied off and secured, and include an acceptable air gap between the discharge point and sanitary flow line. Check with the local sewer department for required conditions of disposal to the sanitary sewer system.

2. Discharge water into a storm sewer system: If the Contractor desires to dispose of water in a public storm system, the water is to be dechlorinated prior to discharge. The Contractor shall provide hoses, temporary pipes and an approved air gap, as required, for discharge. See AWWA C652 Appendix C for chemicals required to neutralize the chlorine residual. Ascorbic acid is included as an acceptable chemical for dechlorinating.

3. Discharge water to ground surface or ditches: If the Contractor desires to dispose of water to the environment, and the Public Works Department approves the request, the water shall be dechlorinated prior to discharge. The Contractor shall provide hoses and temporary pipes as required. See AWWA C652 Appendix C for chemicals required to neutralize the chlorine residual. Ascorbic acid is included as an acceptable chemical for dechlorinating.

630.4.4 Bacteriological Testing

After flushing and disposal of the disinfection mixture, two (2) bacteriological samples will be drawn by the Public Works Department. The first sample will be drawn following a 16-hour retention period. The second sample will be drawn at a minimum of 15 minutes later. Both water samples must pass the bacteriological tests before the water line(s) will be accepted.

All corporation stops used for testing and chlorination shall be removed at the completion of work and replaced with brass plugs prior to final backfilling and surface restoration.

Section 640 Valves and Valve Boxes

640.1 Design Requirements

640.1.1 Isolation Valve Size, Spacing, and Location

A sufficient number of valves shall be provided to facilitate water system isolation and minimize impact to surrounding customers. All system appurtenances shall include a valve for isolation during general maintenance and repair operations.

Generally, valves shall be installed at water main intersections in groups of three (3) for tee applications and four (4) for cross applications. Valves shall be MJ style and include restraints.

The maximum distance between main line valves shall be 500 feet.

All valves 12-inch and smaller shall be gate valves.

All valves larger than 12-inch may be approved butterfly valves, with the exception of Hot taps.

All valves shall be full size. No reduced port valves will be allowed.

Valves shall be installed in areas adequate to allow for a 3-foot clear zone maintained around all water system valve boxes. Fencing, trees, large bushes, retaining walls, and anything else that may interfere with the operation of a water valve is prohibited within the clear zone.

Valves shall not be located within a curb, gutter, driveway, sidewalk surfaced area or ADA ramp.

Valve operator extensions are required on all valves with operating nuts more than 6 feet below finish grade. Oversized valve cans and risers are to be included with all operator extension installations.

Valve box lids located in roadways with high-volume traffic or speed limits 35 mph and greater shall have locking lids, to prevent lid from being dislodged.

Related Standard Drawings: 640-1, 640-2, 640-3

640.1.2 Combination Air Release Valves (CARV)

CARV valves are required at all high points on all transmission and distribution piping where elevation changes are equal to or greater than the diameter of the pipe being installed.

640.1.3 Insertable Valve

At the discretion of the City Engineer, an approved insertable valve may be used on a case-by-case basis.

640.2 Materials

All valves shall be marked with valves size, class, manufacturer, and year of manufacture. Markings shall be cast in raised letters on the valve body.

All valves located inside vaults require a handwheel.

640.2.1 Gate Valves

Gate valves shall be resilient-wedge type conforming to AWWA C509 and/or C515, and shall be UL listed and FM approved.

All gate valves shall be hydrostatically tested at the factory and have a minimum rated working pressure of 200 psi.

The wedge shall be ductile iron or cast iron completely encapsulated with resilient material. The sealing material shall be permanently bonded to the wedge with a rubber tearing bond which meets ASTM D429.

Direct Bury

All direct bury gate valves shall be furnished with a 2-inch square operating nut and open counter clockwise when viewed from above. All buried valves shall have non-rising stems made of solid bronze and include integral or non-integral collars in compliance with AWWA.

Non-Direct Bury

Gate valves installed in backflow vaults or above-ground backflow assemblies shall be outside screw-and-yoke type valves, equipped with a bronze stem, and supplied with a hand wheel.

640.2.2 Butterfly Valves

Butterfly valves shall be rubber-seated type conforming to AWWA C504. Valves shall be bubble tight at rated pressures with flow in either direction, and shall be designed for applications involving valve operation after long periods of inactivity. Valves employing a complete rubber liner or with sprayed or plated seating surfaces are not acceptable.

The valves shall be Class 150B as shown in AWWA C504, Table 2. All butterfly valves shall be hydrostatically tested at the factory and have a minimum rated working pressure of 150 psi.

Butterfly valves shall be furnished with a 2-inch square operating nut and shall open counter clockwise when viewed from above. All manual operators shall be approved for direct bury applications. Valve actuators shall be totally enclosed worm gear or the traveling nut self-locking type, and shall be designed to hold the valve in any intermediate position between fully open or fully closed without creeping or fluttering. All valve actuators shall be capable of withstanding an overload input torque of 450 ft-lbs at full-open or full-closed position without damage to the valve or valve operator.

640.2.3 Valve Operator Extensions

Valve operator extensions can be fabricated using 2-inch by 2-inch by .120-inch square steel tubing or 1-inch schedule 80 steel pipe and ¼-inch steel plate, with 2-inch socket made from ¼-inch thick steel plate or 2½-inch by 2½-inch by .180-inch square steel tubing, then hot dip galvanized.

Related Standard Drawings: 640-4

640.2.4 Valve Boxes

Standard

Valve box tops shall be 18-inch tall "Vancouver" style constructed of cast iron and shall be factory cast with the word "Water." Valve box castings shall be a smooth and uniform cylinder and top rim. Valve boxes of uneven thickness, pitted, or otherwise flawed in the casting will not be accepted. Debris caps are required in all valve boxes unless otherwise stated by the Public Works Department.

Oversized

Valve box tops shall be 12 inches in height with an inside diameter of 9 5/8 inches. Lids are to be inset and have a 10 5/8-inch outside diameter and include a pick notch in top surface for removal. Valve box castings shall be a smooth and uniform cylinder and top rim. Valve boxes of uneven thickness, pitted, or otherwise flawed in the casting will not be accepted. Debris caps are required in all valve boxes unless otherwise stated by the Public Works Department.

Locking Traffic Lid

Valve box tops shall be 18-inch tall "Vancouver" style (same casting as the Standard valve box) with two (2) 3/8-inch diameter, 16 thread, 1¼-inch long stainless steel slotted screws for securing lid to main casting. "City of Beaverton" shall be cast into the lid in ½-inch lettering.

Valve Box Riser

The riser, or bottom section of the valve box, shall be 6-inch or 8-inch diameter SDR 35 PVC pipe (ASTM D3034) as required for valve box size.

Related Standard Drawing: 640-2, 640-3

640.2.5. CARV

¾-inch, 1-inch, and 2-inch CARV's shall have a minimum working pressure rating of 230 psi.

CARV body shall be made of high strength plastic.

The inlet connection shall be male NPT. The vent outlet shall be 3/8-inch female NPT (for ¾-inch and 1-inch valves) and 1½-inch (for 2-inch valves).

All valves, copper tubing, fittings, saddles, and vaults shall meet the material requirements of Section 660 "Water Service Connections".

Related Standard Drawings: 640-5, 640-6, 640-7, 640-8

640.3 Construction

640.3.1 Handling

The Contractor shall follow the manufacturer's instructions and protect valves from damage while transporting, unloading, and during installation. The valve operating shaft shall not be used for lifting. Care shall be taken not to damage the interior and exterior coating on valves. Valves that have chipped or damaged coating shall be repaired or replaced, at the sole discretion of the Public Works Department.

640.3.2 Storage

Store valves inside if possible. Valves stored outside shall be protected from the weather and accumulation of dirt, rocks, and other debris. Do not expose rubber seats to sunlight.

640.3.3 Valve Installation

Valves are to be installed in accordance with the manufacturer's instructions and comply with applicable AWWA requirements.

Thoroughly clean valves, including flange faces of all foreign matter of debris. Prior to installation, the Contractor shall inspect each valve for proper opening and closing operation, and verify that the valve seats properly.

The joining of valves with pipes or fittings shall comply with Subsection 630.3.2. "Pipe Joining."

Valves shall be installed so the stem is plumb with finish grade.

Center the PVC riser pipe on the axis of the operating nut, set plumb and adjust the top of the valve box to finish grade. Any valve boxes found to be off center, out of plumb or not flush with finish grade shall be removed and reinstalled in the proper position.

640.3.4 CARV Installation

CARV's are to be installed in accordance with these Standards and the manufacturer's recommendations. CARV's shall be located as shown on plans or as directed by the Public Works Department.

Install CARV's at the required elevation to maintain a minimum 1% positive grade for the copper tubing from the water main to the CARV.

640.3.5 Valve Operator Extensions

Where depth of the operating nut is more than 6 feet below finish grade, a valve operator extension shall be provided to bring the operating nut to within 24 to 36 inches of the surface. Each valve shall have no more than one continuous-piece valve operator extension. (Multiple piece extensions are not allowed.)

640.3.6 Valve Boxes

Where the valve is located outside of asphalt or concrete finished surfaces, the Contractor shall install a 24-inch by 24-inch by 5½-inch concrete pad around the valve box with No.4 rebar.

All valve box lids shall be tightly fitted and approved by the Public Works Department.

Valve boxes for valves requiring an operator extension and permanent blow-off assemblies, shall be 8-inch diameter "Portland" style constructed of cast iron with the word "Water" factory cast and the words "Portland OR" removed from the casting. The related bottom section shall be cut from a single piece of 8-inch riser material.

Related Standard Drawings: 640-2, 630-3, 630-4, 630-5

Section 650 Fire Hydrants

650.1 Design Requirements

Obtain permit approval from the designated fire code official for proposed hydrant locations prior to submitting design plans.

Generally, fire hydrants shall be located such that no part of any one- or two-family residential building is more than 500-feet from a hydrant, and no part of a commercial, industrial, or multi-family building is more than 250-feet from a hydrant (when measured along an accessible route).

When new water mains are extended along streets where hydrants are not required for the protection of surrounding structures or other fire concerns, fire hydrants shall be provided at a spacing not exceeding 1,000 feet, for transportation hazards. When streets are provided with median dividers which cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.

On-site fire hydrants and systems shall be provided where required by the fire code officials when a portion of the facility or building hereafter constructed or moved into or within the jurisdiction, is more than 400 feet from a hydrant on a fire apparatus access road (as measured by an approved route around the exterior of the facility or building).

Fire hydrants shall not be connected to a water main with less than an 8-inch diameter. However, a 6-inch water main may be approved if the design hydraulic calculations validate the ability to provide for the minimum fire flow regulated by the fire code official.

Each hydrant must be equipped with an independent gate valve for isolation during replacement or repair.

When placed at mid-block locations, fire hydrants are to be installed at a common property line. For ease of operation, fire hydrants shall also be located in areas that allow for the required clear zone.

All efforts shall be made to place fire hydrants outside of new or existing sidewalk and out of proximity to driveways or other vehicle accesses.

Related Standard Drawing: 630-1, 650-1

650.2 Materials

All fire hydrants shall be a dry barrel, traffic breakaway type, and be UL listed and FM approved conforming to AWWA C502.

The main opening valve shall be 5¼ inches compression type, opening against pressure and closing with pressure. The main valve shall open when turned counter clockwise. The valve operating nut shall be a 1½-inch National Standard pentagon nut.

Fire hydrants are to have a minimum pressure rating of 200 psi and be factory tested at twice the rated pressure.

The hydrant shoe must have two (2) positive acting bronze drain valves that completely drain the hydrant by opening when the main valve is closed.

The nozzle section shall consist of two (2) 2½ inch hose connections and one (1) 4½ inch pumper connection. All nozzles shall be field replaceable. The thread type are to be National Standard Fire Hose Coupling Screw Threads.

The ground line connection, between the nozzle section and the barrel, shall incorporate the use of breakable lugs and be designed such that the nozzle section can be rotated to any increment of 360°.

The inside of all hydrants, except for bronze and machined surfaces, shall be coated in accordance with AWWA C502 standards. The exterior coating on the hydrant nozzle is to be painted yellow. The following paint products are approved for use in the City of Beaverton water system: Sherwin-Williams Company (Mueller Yellow, #172-6918 or an approved equal.

Fire hydrants shall be permanently marked with the manufacturer's name, size of valve opening, and year of manufacture.

Granular drain backfill material shall conform to ODOT/APWA Standard Specifications, Section 00430.11 for 1¼ to ¾-inch material.

650.3 Construction

650.3.1 Handling

The Contractor shall take care not to damage interior or exterior hydrant coatings. A strap or approved lifting device shall be used for lifting and setting hydrants, chains and cables are not allowed. Any repair of damaged surfaces below ground level shall be executed as required by the Public Works Department.

Surface damage repairs to coatings of nozzle area (above ground) shall include applying two (2) coats of yellow enamel hydrant paint or as required by the Public Works Department.

650.3.2 Installation

Hydrants are to be installed in accordance with AWWA C600, AWWA Manual M17 and the manufacturer's recommendations. Hydrants shall be located as shown on the approved plans or as directed by the fire code official.

Backfill of hydrants shall comply with Subsection 620 "Trench Backfill and Surface Restoration".

Any hydrant removed from service will require an "Out of Service" rings installed. Out of service hydrants are to be reported to TVFR by the end of the business day.

Hydrant bury depth shall be no more than 6 feet and no less than 30 inches below finished grade.

Hydrants installed in planter strips are to be located in the center of the planter strip, with a minimum distance of 24 inches (from center of hydrant barrel) from all sidewalks, wheelchair ramps or curb lines. At the sole discretion of the Public Works Department, hydrants may be allowed to be closer if conflicts or limitations are present.

Set hydrant elevation so that the traffic breakaway flange is between 3 and 6 inches above finish grade. Fire hydrant extension kits are not allowed for field height adjustments unless approved by the Public Works Department.

All hydrants are to stand plumb with ports parallel or at right angles to the curb, with the pumper connection facing the curb. The Public Works Department shall determine final position of port orientation.

Related Standard Drawing: 650-1, 650-2, 650-3, 650-4

650.3.3 Joints

Joint restraints shall be installed on all joints between the water main and the hydrant.

650.3.4 Base Blocks

Hydrants shall be placed on a 12-inch by 12-inch by 8-inch H solid concrete pier block set on 6 inches of compacted Class B backfill per Subsection 620 “Trench Backfill and Surface Restoration”.

650.3.5 Drainage

For hydrant drainage, place clean granular drain backfill material around the base block, under the hydrant, and to a minimum elevation of 6 inches above hydrant drain openings (4 CF minimum).

650.3.6 Reflectorized Buttons

The Contractor is required to place a blue reflectorized button for each hydrant installed. Buttons are to be adhered to the roadway surface by thermoplastic pads, at the completion of final street surfacing.

Related Standard Drawings: 650-4

Section 660 Water Service Connections

660.1 Design Requirements

660.1.1 Water Services

The City of Beaverton Public Works Department is responsible for serving and maintaining water pipes from the water main to the customer's side of the water meter. Maintaining the piping between the water meter and the property being served is the customer's responsibility.

Developers requesting credit for existing water services that are to be removed as part of development, shall contact the Public Works Department prior to abandonment for information and eligibility. The Developer is responsible for removal of the existing meter box or vault, termination of the connection at the water main, and all necessary street repair and restoration of disturbed areas.

Public Works Department policy is to provide one water service per single tax lot for residential properties. Duplex structures on a single tax lot may be served by two water services. If a structure contains more than two dwelling units or customers on a single tax lot, a master meter must be installed. Subject to Public Works Department approval, commercial, industrial, and multi-family tax lots may be allowed additional services.

Standard water meter sizes available from the Public Works Department are 5/8x3/4-inch, 1-inch, 1½-inch, 2-inch, 3-inch, 4-inch, 6-inch, and 8-inch. The Engineer is responsible to properly size water meters for adequate service for the development, as required by the Oregon Plumbing Specialty Code (OPSC).

5/8x3/4-inch and double 1-inch meters shall be served by a 1-inch copper service line. For flag lots and private tracts, no more than four (4) 5/8x3/4-inch meters are allowed to be grouped together, unless approved by the Public Works Department. A manifold assembly is required to reduce the number of water main taps and help minimize congestion within the public right-of-way for other infrastructure.

Water meters are to generally be located in the public right-of-way adjacent to the street curb (6 inches off back of curb). Depending on the water service size and location, meters located on private property are to be in a recorded easement measuring 5 to 10 feet from each outside wall of the meter vault or box. The Public Works Department has final authority regarding the location of meters to best serve the City's requirements.

Water meters shall not be placed in driveways without prior approval from the Public Works Department. If approved, a traffic rated box and lid will be required.

All water meters must be installed by the Public Works Department.

All meters 1½-inch and larger will require a meter bypass (with the exception of irrigation services).

All meters require a zinc anode to be installed adjacent to and below the water meter service. See section 680 for corrosion protection.

All service line trenches shall be 12" minimum width.

Minimum required cover for service lines between the water main and meter is 30 inches in improved areas and 42 inches in unimproved areas.

Note: The numerical dimensional value describing the water service is the size of the water meter and may or may not correspond with the size of the required pipe or copper tubing.

Related Standard Drawing: 660-1

660.1.2 Fire Services

Commercial and industrial properties where multiple water services are required as part of development (fire, domestic, irrigation) are to be supplied by a common pipe designed to meet maximum water demands for all services. Valves are required to be installed at each service branch for isolation. Fire services are to be designed with an inline valve at the property line to separate public piping from the private fire system.

Related Standard Drawing: ???

660.1.3 Fire Flushing

A controlled flush is required on all commercial/industrial fire sprinkler systems per the current adopted edition of NFPA-24. Contact and arrange for a Public Works Department representative to be on-site during the flushing process. A portable flow meter will be installed by the Public Works Department to monitor water flow rate and water usage of all flushed water.

A cleared area shall be left accessible on the fire system riser pipe for installation of the flow meter sensor. The necessary clear area distances between the flow meter sensor and miscellaneous fire system valves and fittings are shown in the table below.

Table 660.1 – Required Fire Service Flow Meter Clearance Distances

Subject	Distance Away (Diameter)
Valves	≥20 x D
Pumps	≥20 x D
90° Bend	≥15 x D
Inlet Run	≥15 x D
Outlet Run	≥3 x D

If adequate space is unavailable on the fire system riser pipe an alternate sensor location will need to be determined, requiring Public Works Department approval.

660.2 Materials

All materials for water services with 5/8x3/4-inch through 2-inch meters shall conform to AWWA C800 and be new and undamaged.

Brass products furnished under this specification, which are not in contact with potable water shall have an alloy composition of copper, tin, lead and zinc in accordance with ASTM B62. The material is to be copper alloy UNS C83600, commonly referred to as 85-5-5-5.

All brass components that are designed to be in contact with potable water must be made from either CDA/UNS Brass Alloys C89520 or C89833 with a maximum lead content of 0.25% by weight and comply with ANSI/AWWA C800 and ANSI/NSF Standard 61 Annex G.

Brass fittings shall comply with the Safe Drinking Water Act, as amended, and the U.S. Environmental Protection Agency (EPA).

Unless otherwise noted, all fittings and valves shall have a minimum working pressure of 150 psi.

All fittings shall either be stamped or embossed with the manufacturer's name or trademark.

660.2.1 Copper Tubing

All 3/4-inch and 1-inch tubing shall be annealed, seamless, type K soft copper tubing conforming to ASTM B88. All copper for 1½-inch and 2-inch meter water services shall be hard drawn temper (rigid), type K copper tubing, in 20-foot lengths conforming to ASTM B88.

The tubing shall be coupled using compression fittings having a positive gripping feature to prevent tubing pull-out.

660.2.2 Corporation Stops

All corporation stops shall be full port opening, ball-valve design and have a flow passage area equivalent to the fitting outlet flow area.

Corporation stops for ¾-inch and 1-inch direct taps shall be manufactured with AWWA CC tapered inlet threads and CTS compression type outlets with positive gripping feature.

1-inch corporation stops requiring tapping saddles shall be manufactured with external CC thread inlet and TLS compression type outlet.

660.2.3 Copper Meter Setters

2 inch copper meter setters are required on all water services with 1½-inch and 2-inch meters. These shall be designed for vertical inlet and horizontal outlet FIPT connections.

The vertical height of a copper meter setter shall be 15 inches for all water services with 1½-inch and 2-inch meters, and include a high or elevated by-pass assembly.

Copper meter setters shall include two (2) angle ball valves, one (1) at the inlet to the meter, and one (1) at the outlet of the meter. Angle ball valves are to be full port and include drilled wings for padlock installation.

All solder used in the manufacturing of copper meter setters shall be lead free.

660.2.4 Tapping Saddles

Tapping saddle bodies shall be cast from ductile iron, meeting or exceeding ASTM A536, and have a minimum pressure rating of 150 psi.

Tapping saddles shall have double straps. Each strap shall have a minimum width of 1½ inches. Straps, bolts, nuts and washers shall be heavy duty type 304 stainless steel. Pipe sizes 4 inches and greater are to have 5/8-inch diameter bolts. Pipe sizes 3 inches and less may use 1/2-inch diameter bolts.

Tapping saddle outlet shall be internal CC thread to match the corporation stop threads. Tapping saddle thread much always match corps.

Tapping saddle gaskets shall be rubber or approved synthetic rubber. Saddles shall have a minimum pressure rating of 150 psi.

Tapping saddles are required to have an epoxy coating.

Tapping saddles are required for all 1-inch taps on a 4-inch pipe, taps on a 2-inch pipe and all 2-inch taps. For taps 3-inch and larger see Subsection 630.2.7. “Tapping Sleeves”.

660.2.5 Coupling and Elbows

Joints shall be CTS compression type with positive gripping feature or iron pipe thread (NPT).

Copper sweat fittings may be allowed on 1½-inch and 2-inch services on a case-by-case basis only. The Contractor shall contact the Public Works Department for approval.

660.2.6 Repair Bands

Repair bands shall be manufactured from Type 304 Stainless Steel and include ductile iron lugs per ASTM A536.

Bolts shall be made of high strength, low alloy, corrosion resistant steel conforming to AWWA C111/A21.11.

Gasket shall be Nitrile or virgin styrene-butadiene (SBR) rubber.

660.2.7 Sample Stations

Sample stations shall be stainless steel above-ground freeze-proof type with a locking aluminum cover. See approved materials list.

The inlet connection shall be female iron pipe thread (NPT).

All interior parts shall be extractable for maintenance without excavation.

Related Standard Drawing: 660-2

660.2.8 Meter Box and Covers

Meter boxes and lids shall be made of Polymer concrete only.

All meter box lids shall have the word "Water Meter" cast into the exterior surface.

Meter box lids shall be equipped with a cast iron reader lid, unless H-20 load rated.

5/8-3/4-inch and 1-inch Meter

Boxes shall be 13 inches wide by 24 inches long by 12 inches deep.

Meter box lids to be H-20 load rated concrete polymer.

1½-inch and 2-inch Meter

Meter boxes and lids shall be 17 inches wide by 30 inches long by 18 inches deep.

Meter boxes and lids shall be H-20 load rated.

3-inch to 8-inch Meter

Meter vault required see Subsection 670 "Precast Concrete Vaults".

660.2.9 Water Service Valves (1-1/2-inch through 2-inch)

All angled or straight meter valves shall be full port opening, ball valve design, and have a flow passage area equivalent to the fitting outlet flow area. Both angle and straight meter valves shall have drilled wings for padlock installation.

All angled meter valve inlet connections shall be CTS compression type with positive gripping feature.

660.3 Construction

Meter boxes and vaults for water services shall remain at finish grade and accessible at all times. Customers are responsible for maintaining a minimum 3-foot clear zone around these facilities, including landscape, fencing, retaining walls, signs etc.

The methods employed for handling and placing materials and equipment for construction of water service installation shall ensure that all piping and appurtenances are in good condition after installation and testing. Should damage occur to pipe, tubing, fittings, or other equipment, repairs and/or replacement will be required to the satisfaction of the Public Works Department.

Backfilling of water services shall comply with Subsection 620 "Trench Backfill and Surface Restoration".

Water services may be installed using trenchless installation methods such as boring or "Hole-Hawgs". Trenchless installation may be required for new or replacement services within existing roadways.

660.3.1 Installation of Water Meters

The Public Works Department will furnish and set all water meters. Water services shall be activated by a Public Works Department representative, not the Contractor. Service activation will take place following approval of plumbing inspection, testing and approval of any required backflow prevention assemblies, and confirmation of all fees paid in full to the Public Works Department.

660.3.2 Service Placement

Water meter boxes shall be located in the public right-of-way adjacent to the street curb (6 inches from back of curb). Meter vaults shall be installed in the public right-of-way and per Section 670 "Precast Concrete Vaults"

Meters located on private property shall be in a recorded public water easement measuring 5 to 10 feet from each outside wall of the meter vault or box. The Public Works Department has final authority regarding the location of meters to best serve the City.

Water services shall be installed perpendicular to the street centerline or curb line and located where shown on plans.

Meter boxes are to be placed outside of traffic areas (such as driveways, sidewalks and roadways) whenever possible. When a meter box is approved to be installed in a traffic area, the box and lid shall be H-20 load rated. See Subsection 660.2.9. "Meter Box and Covers".

660.3.3 Service Taps

Service taps shall be a minimum of 18-inches from water main joints and fittings and minimum 12 inches from another tap. Multiple direct taps in sizes ¾-inch or 1-inch shall be staggered if installed closer than 2 feet apart.

All service Hot taps must be installed by an approved tapping contractor and under the direction of a Public Works Department representative. Contact the Public Works Department for a list of approved contractors.

Service taps on 4-inch and smaller water main pipe shall be tapped through a tapping saddle, with the exception of ¾-inch taps on 4-inch pipe which may be direct tapped. Service taps on 6-inch and larger ductile or cast iron water main pipe can be directly tapped for ¾-inch or 1-inch copper tubing, and tapped with a tapping saddle or sleeve for 1½-inch and larger meter water services.

660.3.4 Small Water Services (5/8-3/4-inch through 2-inch meters)

Service lines for 5/8x3/4-inch meters shall be 1-inch type K soft copper tubing with compression fittings. Service lines for single 1-inch meters shall be 1-inch type K soft copper tubing with compression fittings. Service lines shall consist of one continuous piece of copper. No splices will be allowed unless the service is over 60 feet in length and/or is approved by the Public Works Department.

Service lines for both 1½-inch and 2-inch meters shall be 2-inch type K rigid copper tubing with compression fittings, and shall have a 2-inch curb stop valve installed at the water main connection. Curb stop valves for 2-inch service lines shall be supported by an 8-inch by 8-inch by 8-inch concrete pier block placed on undisturbed earth or compacted pipe zone material.

See Subsection 620 "Trench Backfill and Surface Restoration".

The Contractor shall follow the manufacturer's recommended tightening method for brass compression fittings. Do not exceed the manufacturer's recommended torque specifications for each specified fitting type.

The Contractor shall prepare all iron pipe (NPT) and CC threads (AWWA) with Teflon tape or pipe thread compound prior to installation.

The cutting of copper tubing shall be done in a neat and precise manner. Cuts shall be smooth, straight, and at right angles. After cutting, the tubing shall be reamed with a copper reaming tool to remove all roughness and sharp edges.

All services with meters 2 inches and less shall be marked on the adjacent top of curb. New curb shall be stamped with a minimum 1-inch tall, ¼-inch deep, "W" mark, directly on top of the curb. Existing curb shall be etched with a minimum 1-inch tall "W", minimum 1/8-inch deep.

Related Standard Drawings: 660-3, 660-4, 560-5

660.3.5 Large Water Services (3-inch through 8-inch meters)

For large water service vaults, see Subsection 670 "Precast Concrete Vaults".

660.3.6 Service Testing and Disinfection

Water services that are installed along with water main improvements must be hydrostatic tested and disinfected prior to use, in accordance with Subsection 630.4 "Flushing, Hydrostatic Testing, and Disinfection".

If the water services are 20 feet long or less and not installed with other water system improvements they may, at the Public Works Department's discretion, be treated with 1% hypochlorite solution prior to assembly. The interior of all pipe, fittings, and valves shall be thoroughly cleaned and then swabbed, sprayed, or dipped in 1% hypochlorite solution.

All corporation stops used for testing and chlorination shall be removed prior to service availability, after testing, and later replaced with brass plugs.

660.3.7 Fire Service Installation

When installing private fire mains, the underground piping from the water supply to the system riser, lead-in connections to the system riser, and all hydrants shall be completely flushed before a connection is made to downstream fire protection system piping.

Coordinate with the Building and Public Works Department for underground piping inspection and fire riser installation. When flow rates utilizing a temporary flow meter are unattainable, an alternate solution may be approved by the Public Works Department.

Section 670 Precast Concrete Vaults

670.1 Design Requirements

Vaults are required with all 3-inch and larger water meter and backflow assemblies. All vault assemblies shall be equipped with an approved gravity drain line to a storm sewer or drained to daylight. When adequate gravity drainage is not available, a plumbed sump pump assembly may be approved by the Public Works Department.

Vaults shall be equipped with electrical power and adequate lighting when required by the Public Works Department. Vault assemblies are not be placed in sidewalks or other pedestrian walkways, unless absolutely necessary. At the sole discretion of the Public Works Department, installation in these restricted zones may be approved on a case-by-case basis. All vaults in walkways shall include a non-slip coating on the access hatch and the hatch drain plumbed to a storm system or other approved location. Contact the Public Works Department for vault lid/hatch requirements in and around vehicle access areas.

All vaults in high ground water levels shall be designed against floating with a safety factor of 1.50. The Engineer shall contact the Public Works Department regarding vault installation in high groundwater areas. Approval of these vaults is on a case-by-case basis only.

670.2 Materials

670.2.1 Precast Concrete Vaults

Vault structural design shall conform to ASTM C-857 and be constructed to withstand an H-20 load rating with a 30% impact factor.

Concrete for the manufacturing of vaults shall conform to ACI-318 and have a minimum compressive strength of 4500 psi after twenty-eight (28) days.

Vault rebar shall conform to ASTM A615 Grade 60 and wire mesh shall conform to ASTM A185 Grade 65.

Horizontal vault joints shall be sealed using a butyl resin sealant.

Where shown on the Standard Drawings, pipe blockouts shall be provided in vault walls.

Vaults shall be manufactured with a minimum 12-inch diameter by 3-inch depth sump, in the location shown on the applicable Standard Drawing.

Exterior walls and base of the vault must be waterproofed. Asphalt compounds of brush or spray consistency conforming to ASTM D449 may be used with the City's approval. Vaults waterproofed using clear compounds shall be marked in black paint or permanent marker which indicates the type of waterproofing material used.

Precast concrete vaults shall be furnished to the dimensions shown and as specified on the Standard Drawings.

670.2.2 Ladders

Vaults shall be equipped with fabricated steel ladders meeting the applicable OSHA requirements and drawings. Steel ladders and accessories are to be hot-dipped galvanized after fabrication.

Aluminum ladder extensions are required and must extend at least 3 ½ feet above vault lid, see Approved Products List.

Mounting bolts for ladders shall be ½-inch stainless steel provided by the manufacturer or product vendor.

All required hardware for vault ladders and other vault accessories shall be supplied or approved by the vault manufacturer.

Related Standard Drawing: 670-1

670.2.3 Sump Pumps

All sump pumps must be 115-volt plug-in type, not hard wire installed.

Sump pumps shall be furnished with an oil-filled, 0.3 hp energy efficient, 115 volt, 8-10 amp motor. Motor windings are to contain automatic thermal overload protection.

All sump pumps must be UL listed.

The pump shall be controlled by a wide angle float switch incorporating a three pronged piggyback plug arrangement.

Pump casing shall be watertight with a 1½-inch NPT discharge that is able to pass up to ½-inch solids.

Sump pumps shall include a 1½ -inch PVC check valve/ball valve/union combination unit on the discharge pipe.

If there is no electrical power accessible or there is a safety hazard in trying to get power, a high and dry water powered pump may be installed, at the discretion of the Public Works Department.

Related Standard Drawing: 670-2

670.2.4 Vault Access Hatches

Pedestrian rated access hatches shall be manufactured from type 6061-T6 aluminum for bars, angles, and extrusions and type 5086 aluminum for diamond plate exterior surface. Provide a recessed lift handle with lock latch assembly. The slam lock keyway shall be protected by a threaded removable plug that sits flush with the exterior surface. All aluminum in contact with concrete shall be coated with a bituminous coating.

Vault lids that are approved for installation in pedestrian walkways shall treated with an approved non-slip surface having a static coefficient of friction between 0.80 and 1.00 as specified by ASTM C1028.

For pipe connection, the access hatch channel drain shall be supplied with a 1½-inch PVC coupler on the underside of the channel frame for drain pipe connection.

Backflow Assembly vaults shall be furnished with heavy duty, hot-dipped galvanized diamond plate steel access hatches (doors) with spring assist and locking latches.

All hatch doors for areas with potential vehicle impacts, including pedestrian walkways, are to be H-20 rated.

670.2.5 Access Manholes

A manhole-style access lid will be required for applications where vaults are installed within public streets and roadways or high density traffic areas. Provide a 30-inch frame and lid together with any required concrete riser rings. Riser rings shall be H-20 load rated with a max height of 12". The manhole lid shall have the letter "W" cast in the exterior surface.

To provide a water tight seal, joint sealant shall be applied between the manhole casting/riser ring joints and riser ring/vault joints.

670.2.6 Pipe Supports

Pipe supports shall be manufactured from corrosion resistant galvanized steel and be bolted directly to a class 125 pipe flange.

Pipe supports shall be tested to a minimum compressive strength of 10,000 pounds.

All pipe supports are to be adjustable and include stainless steel hardware for anchoring the base to the vault floor.

670.3 Construction

Install all vaults according to the applicable Standard Drawings.

Carefully inspect all precast vault sections prior to installation. Do not use vault sections with chips or cracks in the tongue. Install gasket material in accordance with manufacturer's instructions and only use primer furnished by the gasket manufacturer.

Vaults are to be placed on a minimum 6-inch layer of compacted Class "B" backfill material per applicable Standard Drawing. Where poor ground conditions unsuitable for vault support are encountered, over-excavate and add foundation stabilization material, per Subsection 620.3.2 "Pipe Bedding and Trench Backfill".

Vault lid elevation shall be 3 to 5-inches above the finished ground surface, with the exception of a vault approved by the Public Works Department for installation within a sidewalk or other pedestrian walkway. Vault hatches within walkways are to have hatch drains plumbed to an approved storm system, or as required by the Public Works Department.

Installation of sump pumps shall include a line sized check valve, ball valve, union fitting and a Schedule 40 PVC pipe and fittings. Sump pumps shall not discharge water into the public right-of-way.

If approved, provide electrical service to the vault with a voltage compatible with the sump pump motor, any vault lighting, and in accordance with applicable electrical codes. Conduit for power shall maintain minimum two feet separate from all other pipe penetration.

Pipe inlet and outlet penetrations shall be made through manufactured pipe block-outs. Holes shall be made by core drilling or by drilling a series of small diameter drill holes no more than 2 inches apart along the circumference of the opening. Openings shall be no larger than 2 inches greater than the flange diameter of the pipe being installed. All wall penetrations for pipe or conduit shall be sealed with non-shrink grout, a mechanical pipe seal, or approved equal.

All pick holes created during manufacturing are to be filled with grout prior to completion.

Vaults shall be watertight throughout the full depth, including pipe inlets and outlets.

Related Standard Drawings: 670-1, 670-2, 670-3

Section 680 Corrosion Protection

680.1 Design Requirements

Corrosion protection may be required where water systems are in close proximity to utility infrastructure carrying electrical current or where the natural soil has aggressive/corrosive conditions. Protection measures may include: minimum separation requirements, application of protective coverings and coatings, pipe joint bonding, and installation of dielectric isolation and galvanic anodes. Cathodic protection (CP) test stations will typically be required in combination with corrosive soil and stray current mitigation methods to evaluate and monitor corrosion protection effectiveness.

Franchise utility installations that are in close proximity and considered a corrosion risk by the Public Works Department, will require the utility to submit a mitigation plan addressing liability and means and methods for reducing stray current impact to the Public Works Department's water system infrastructure. Utilities that are of primary concern for stray current include: NW Natural Gas piping (infrastructure utilizing an induced current cathode protection system), high voltage power lines such as BPA and PGE (overhead and underground transmission installations), and TriMet MAX Light Rail electrical system (area within 100-feet either side of tracks and within 500-feet of a power traction substation).

Corrosion control design shall specifically include the following:

Transmission Mains - Transmission mains are piping systems with minimal service connections including conduits, interties, supply mains, and pump mains. Transmission mains shall be made electrically continuous with welded joints or joint bonds, shall be dielectrically isolated at all connections, and shall be dielectrically isolated into sections of 750-foot maximum length.

1. Transmission mains crossing an electric rail track shall be cased under the track and for a minimum of 10-feet horizontal distance beyond the track slab.

2. Test stations shall be provided at dielectric isolation joints, casings, where transmission mains cross cathodically protected foreign lines, and as shown.

3. Transmission mains made of ductile iron pipe shall be zinc coated ductile iron pipe and have V-Bio polyethylene tube encasement and anodes. Steel transmission mains shall have tape wrap and anodes. Mortar-coated steel and concrete cylinder pipe (CCP) transmission mains shall have continuous mortar coating over all in-line valves, fittings, and special appurtenances, or when directed by Engineer, inline valves, fittings and special appurtenances shall be dielectrically coated and protected with anodes. All branch lines that are not mortar-coated shall be dielectrically isolated from the mortar coated main.

Distribution Mains and Services:

1. Ductile iron distribution mains shall be zinc coated ductile iron pipe and have V-Bio polyethylene tube encasement, and where distribution pipe is polyethylene encased the copper service lines shall have supplemental zinc anodes.

2. Cathodically Protected Foreign Lines - Distribution pipe and copper services crossing a cathodically protected foreign line shall be sleeved in PVC pipe or sleeved with a PVC geo-membrane wrap for a minimum of 10-feet from the centerline of the foreign line. Copper service pipe shall be tape-wrapped

within the PVC pipe or geo-membrane wrap. Distribution pipe paralleling a cathodically protected foreign line shall be installed with a minimum of 5-feet skin-to-skin separation between pipes.

3. Electric Rail Systems - Distribution pipe crossing an electric rail system shall be cased under the track and for a minimum of 10 feet beyond the track slab. Copper services crossing electric rail track shall be tape wrapped and sleeved in PVC pipe under the track and for a minimum of 10 feet beyond the track edge. Distribution pipe paralleling an electric rail shall be installed with a minimum of 10 feet horizontal separation between track slab and edge of the pipe. The pipe shall be made electrically continuous with joint bonds, shall be dielectrically isolated at all connections, and shall be dielectrically isolated into sections of 500 feet maximum length. In addition, the pipe shall have polyethylene encasement, anodes, and test stations.

4. Copper Services on Ductile Iron Pipe Wrapped in Polyethylene Encasement – Where distribution pipe is wrapped in polyethylene encasement the copper services shall have supplemental galvanic anodes. Attach zinc anodes directly to the copper service lines, alternately, if the ductile iron pipe is joint bonded and cathodically protected and if the copper services are electrically continuous with the ductile iron pipe, zinc anodes are not required.

Casings - Casing pipe shall have welded joints, dielectric coating, and be protected with galvanic anodes. Casing pipe installed in an open trench shall have tape wrap coating, and casing pipe that is bored shall have epoxy coating with field-coated joints and all appurtenances shall be epoxy coated. Casing installations shall include dielectric spacers, end seals, anodes, and test stations.

Piping in Vaults and Facilities - Piping in vaults and above ground facilities shall be painted with a leafing aluminum epoxy mastic. All pipe hangers and pipe supports shall be hot-dip galvanized.

Pipe on Bridges - Pipe on bridges shall be painted with leafing aluminum epoxy mastic system, an epoxy/polyurethane coating system, or a moisture-cured urethane coating system. All pipe hangers and pipe supports shall be hot-dip galvanized.

All corrosion protection equipment, materials, and workmanship shall conform to the National Electrical Code, National Association of Corrosion Engineers, American Water Works Association, and manufacturer's installation recommendations. Materials in contact with potable water shall be certified NSF 61.

Related Standard Drawing: 680-3 and 680-4

680.2 Materials

680.2.1 CP Test Stations

Wire and Cable

Wire for test stations shall be insulated with high molecular weight polyethylene (HMWPE), thermoplastic heat and water resistant nylon coated (THWN), cross-linked high heat water resistant insulated wire (XHHW), or rubber insulated building wire (RHW) and be American wire gage (AWG) stranded copper with a 600-volt service rating. Wire size and color requirements can be found on the applicable Standard Drawing or as directed by the Public Works Department.

Cathodic Protection Monitoring Coupons

Provide coupons, steel or ductile iron, to match the pipe material type. The coupon shall have two (2) wires connected with a silver soldered potted connection, and with a minimum length of 10-feet. Provide MC Miller IR-Free coupons or approved equal. The coupon access drop tube shall be Schedule 40 PVC pipe, 2-inches in diameter, and if the test station is offset from the structure then the coupons shall be directly attached to a copper/copper sulfate reference electrode in the same manner as attached to an access drop tube.

Post Mount (Type A)

Test Box: Cast aluminum suitable for slip-fit mounting to 3-inch rigid galvanized conduit.

Terminal Block: Plastic or glass-reinforced laminate, 1/4-inch thick with five terminals.

Terminals shall have special heads to prohibit movement and be easily accessible from both sides without requiring removal. Terminal studs, washers, and nuts shall be nickel-plated brass.

Post Mount (Type B)

Test Stations shall include nickel plated or stainless steel hardware. Cap, terminal board and collect nut shall be manufactured from Makrolon polycarbonate plastic with three (3) wire terminals accessible from both sides of the board. Support posts shall be 1¼-inch in diameter with a 5 feet length. Color shall be blue.

Flush Mount (Type C)

Test stations are to be installed in a polymer concrete utility box with dimensions of 10-inch x15-inch x12-inch and include a 20K load rated polymer concrete traffic lid.

A phenolic terminal board, ¼-inch thick, shall be waterproof and sufficiently sized to accommodate termination of all required wire and connectors. Terminals shall be provided with studs, fasteners, stand-offs, and other hardware and shall be brass or copper, UL 486. Terminal labeling shall be engraved in the panel board, 1/4-inch high letters, 1/32 to 1/16-inch deep.

Flush Mount (Type D)

Test station base is to be constructed of 4" ABS with a height of 18" and designed for a drop in lid. The lid and rim shall be heavy duty cast iron with "CP Test" cast in the exterior lid surface. The terminal block shall be secured beneath the lid and manufactured from a polyester laminate with brass terminals. Machine screws and nuts shall be 1/4-inch, 20 thread, nickel plated with lock washers.

Flush Mount (Type E)

Test Stations shall be the City standard valve box and cover (CIV) with an 8-inch diameter PVC pipe, extending a minimum of 24-inch from finish grade to bottom of pipe.

A phenolic terminal board, ¼-inch thick, shall be waterproof and sufficiently sized to accommodate termination of all required wire and connectors. Terminals shall be provided with studs, fasteners, stand-offs, and other hardware and shall be brass or copper, UL 486. Terminal labeling shall be engraved in the panel board, 1/4-inch high letters, 1/32 to 1/16-inch deep.

Related Standard Drawing: 680-1, 680-2, 680-6, and 680-7

680.2.2 Exothermic Welding and Pin Brazing

Cable and wire connections to pipe and fitting shall be made with an exothermic weld kit specifically designed by the manufacturer for welding the material type. Supply all necessary molds, cartridges, tools and supplies for performing exothermic welding as required. Manufacturer's equipment and supplies are not to be interchanged with another manufacturer's products.

Welder molds shall be graphite, ceramic molds will not be allowed. Cartridge load size recommendations from the manufacturer shall be followed closely with regard to pipe size, pipe material type, and wire or cable size. Welding charges for use on cast and ductile iron are different from those used on steel.

Terminals - All wires used with exothermic welds shall have formed sleeve terminals and shall be welded using the reduced weld size and special weld mold for formed terminals, as specified in writing by the manufacturer. The formed terminals may be factory fabricated or may be field formed using sleeves and a hammer die. Connections to mortar coated steel or concrete cylinder pipe shall be exothermically welded to a 1/2-inch diameter steel rod preinstalled on the pipe by the pipe manufacturer.

Portable pin brazing equipment is an approved method for bonding cable and wire to pipe and fittings. Follow manufacturer's recommended procedure and use appropriate equipment for the size of wire being attached and type of pipe material being bonded. Pins, studs, lugs and ferrules shall be as recommended in writing by the manufacturer for the wire size, pipe material, and pin braze machine settings.

All exothermic welding and pin brazing equipment and supplies are to be submitted to and approved by the Public Works Department prior to performing work.

Related Standard Drawing: 680-9

680.2.3 Weld / Brazing Caps

Furnish weld caps of high-density plastic, 10 mils (minimum) thickness Handy Cap IP, as manufactured by Royston Laboratories, or approved equal. Provide caps that incorporate a dome for the weld, a tunnel to contain the lead wire from the weld connection, and a base plate to cover the prepared pipe surface. Weld caps shall be provided pre-filled with mastic/adhesive and have an integral primer for adhesion to the pipe or structure. Weld caps shall be sized for the exothermic or pin brazed connection.

680.2.4 Wire and Cable

Joint Bonds

Wire/Cable for joint bonds shall be HMWPE insulated, AWG stranded copper rated for 600 volts. Wire/Cable size and color requirements can be found on the applicable standard drawing or as directed by the Public Works Department.

680.2.5 Reference Electrodes

Zinc reference electrodes shall be 1.4-inches by 1.4-inches by 9-inches long and cast of high purity zinc in accordance with ASTM B418.

Copper / Copper-Sulfate reference cells shall be “permanent” type, designed for direct burial with a minimum thirty (30) year life.

1. Zinc reference cells shall be pre-packaged in a permeable cloth bag with a proprietary backfill mix to retain moisture and minimize migration of contaminants from surrounding soil. Copper/Copper sulfate reference cells shall be in a plastic tube with ceramic plug, nominal 1- inch diameter by 8-inch length.

2. Reference cells are to be equipped with No. 12 or No. 14 AWG stranded copper lead wire with yellow HMWPE insulation of suitable length to reach test station for proper installation without splicing (10 feet minimum length).

680.2.6 Galvanic Anodes

Supply galvanic anodes of the quantity, composition, dimensions, metal weight, and packaged backfill as shown or noted on the drawings

Magnesium Anodes - Provide magnesium anodes, nominal 20- inches long and nominal 30-pound bare metal weight. Magnesium anodes shall meet the requirements of ASTM B-843-M1C High Potential Magnesium Alloy and ASTM G97 with an open circuit potential of (-)1.7VDC to CSE and a current efficiency of 50%. The anodes shall be prepackaged in a permeable cloth bag containing the manufacturer’s prescribed backfill and the packaged anode shall be a nominal of 2.5 times the bare anode weight. The anode lead wire shall be solid copper wire, AWG #12 or #10, with TW-, THHN-, or USE-type insulation, and the connection to the anode shall be silver soldered by the manufacturer and shall be of an un-spliced length specific to the application but not less than 15-feet.

Zinc Anodes – Provide zinc anodes high purity zinc in accordance with ASTM B418., nominal 1.4-inches x 1.4-inches x 9-inches long, and 5-pound bare metal weight. The anodes shall be prepackaged in a permeable cloth bag containing the manufacturer’s prescribed backfill and the packaged anode shall be a nominal of 2.5 times the bare anode weight. The anode lead wire shall be solid copper wire, AWG #12 or #10, with TW-, THHN-, or USE-type insulation, and the connection to the anode shall be silver soldered by the manufacturer and shall be of an un-spliced length specific to the application but not less than 15-feet.

680.2.7 Dielectric Isolation

Insulating Flange Joints - Flange insulation shall include a full face insulating gasket, a full-length insulating sleeve for each bolt, and two (2) insulating washers and two (2) steel bearing washers for each flange bolt.

1. Sleeves and Washers - Insulating sleeves and washers shall be Pyrox G-10. Both the insulating washers and the steel washers shall fit over the outside diameter of the sleeve and shall fit within the bolt facing of the flange. The oversized steel washer is in addition to the standard high strength washer required for high strength bolts.

5. Gaskets - Gaskets shall be full faced, Styrene Butadiene Rubber (SBR)**,** Nitrile (Buna-N), Neoprene, polytetrafluoroethylene (PTFE), or compressed vegetable fiber. Gaskets shall have adequate dielectric properties, 300V/mil minimum, and shall be suitable for the operating and test pressures of the pipe system. Isolation gaskets with sealing rings such as Linebacker by GPT are typically not compatible with AWWA flange finish or dimensions and are not permitted. The ID and OD of the two flanges and of the gasket must be included in the gasket submittal. Submittals for bulb/ribbed type gaskets must show the number and diameter of the bulbs/ribs.

Insulating Flanged Joint Assembly - An insulating joint assembly shall consist of 2 flange by plain end or 2 flange by mechanical joint (FLG x PE or FLG x MJ) adapters, a full face insulating gasket, with full length insulating sleeves, 2 insulating washers, and 2 steel bearing washers for each flange bolt.

Related Standard Drawing: 680-10

Flexible Coupling with Insulated Boot

Insulating Flexible Couplings - Flexible couplings size 12-inches in diameter or smaller shall be ductile iron and couplings larger than 12-inches in diameter shall be steel. All flexible couplings shall be fusion-bonded epoxy coated and furnished with high strength alloy bolts and nuts.

1. Insulating Boots - Provide insulating flexible couplings with two insulating boots that cover and prevent contact between pipe ends. Insulating flexible couplings shall be Romac Industries, Inc. style IC501 or IC400 or approved equal.

6. Reducing Flexible Couplings - Where couplings are for differing pipe sizes use reducing couplings with same size gaskets. Transition couplings with differing size gaskets are not acceptable. Couplings must meet AWWA C219 requirements. Couplings shall be specially ordered and sized for an insulating boot on one side and thrust restraint on the other side.

Insulating Copper Service Fittings - Fittings shall have insulators integral to the body of the fitting, as manufactured by Mueller Company or approved equal. The design of the fitting shall include a mechanical restriction to prevent the copper tube from passing through the insulation.

Insulating Wall Seals - Wall seals shall consist of compression disks and pressure plates made of dielectric materials. Insulating wall seals shall be Model C Insulating Type as manufactured by Link Seal or approved equal.

680.2.8 Wire Connectors and Splice Connections

Wire Connectors (Test station terminals):

One-piece, tin-plated crimp-on lug ring connectors.

Splice Connectors (AWG 10 and larger wire):

Splice connections shall be made using copper or bronze split bolt connectors.

Splice Connectors (AWG 12 and smaller wire):

One-piece, tin-plated crimp-on connectors, or made using copper or bronze split bolt connectors.

680.2.9 Electrical Tapes

Electrical Tape:

Vinyl electrical tape shall be 7 mil, minimum thickness, and be designed for primary insulation and jacketing for splices/repairs rated up to 600V.

Insulating Putty:

Insulating putty is to be 125 mil self-fusing tape for connections rated up to 600V.

Rubber Splicing Tape:

30-mil Ethylene Propylene self-bonding tape.

680.2.10 Conduit and Fittings

PVC:

Conduit shall be Schedule 40 PVC, NEMA type II, UL listed for concrete encasement and underground direct burial. Fittings shall be Schedule 40 PVC, NEMA type II, solvent-weld conduit connections as recommended by conduit manufacturer.

Rigid Steel:

Conduit shall meet requirements of and be installed in accordance with NFPA Code 70. Fittings shall meet requirements of UL 514B. Connections shall be thread type, with the exception of the slip fit test station connection. Both conduit and fittings shall be hot-dip galvanized with chromate protective layer, conforming to UL 6.

Cable Warning Tape:

Cable warning tape shall be 3-inch wide, yellow with black letters to say “Buried Electrical Line”.

680.2.11 Pipe and Fittings Tape and Encasement Materials

Polyethylene Encasement shall be installed on all DI pipe and fittings. Provide V-Bio Enhanced Polyethylene Encasement of not less the 8 mils thickness. Encasement be installed in accordance with AWWA C600 and ANSI/AWWA C195/A21.5 and recommendations of the AWWA M41 *Manual of Water Supply Practice – Ductile Iron Pipe and Fittings.* Specifically, the wrap shall be overlapped one foot in each direction at joints and secured in place around the pipe and any wrap at tap location shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

Tape Wrap Coating for Casing - Provide tape wrap coating for casing pipes in accordance with AWWA C203, AWWA C209, AWWA C214, or AWWA C216. Provide tape system per manufacturer’s requirements for repair and to cover holdbacks.

Tape Wrap for Copper Tube - Provide a 20 mil minimum PVC tape wrap coating for copper services and insulating joints. Provide Scotchwrap 51 or approved equal.

Tape Wrap Coating for Specials - When specified provide petrolatum wax tape system per AWWA C217 with an auxiliary thin film conforming stretch outer wrap.

Casings and Sleeves

Casing Spacers and Casing End Seals - Casing spacers shall be constructed with fusion-bonded epoxy coated steel bands and reinforced insulating runners. If stainless steel bands are approved by the Owner, the bands shall be separated from the pipe with a manufacturer’s elastomeric boot. Casing end seals shall be pull-on style with stainless steel clamps, custom sized for the OD of the casing and carrier pipe. Provide end seals, Type C, as manufactured by PSI or approved equal. Polyethylene encasement shall extend through the end seal and casing.

Sleeve Slip-on and End Seals - Sleeves shall be ASTM D1785 Schedule 80 PVC pipe, 4-inch minimum pipe diameter.

1. Sleeve End Seals for DI Pipe- End seals for sleeved pipe shall be concentric elastomeric couplings PVC to DI with stainless steel clamps as manufactured by FERNCO, Inc. or approved equal. Couplings shall be sized to specific pipe type and size.

2. Sleeve End Seals for Copper Service - End seals for sleeved copper services shall be pull on elastomeric molded pipe sleeve seals with stainless steel clamps. Provide pipe sleeves by Fernco, Inc. or approved equal. Step down from 4-inch to the required copper tube size with schedule 80 PVC reducers. Molded end seals shall be sized specific to the pipe type and size.

3. Sleeve Wrapped - Furnish 40 mil PVC reinforced geo-membrane with 300V/mil dielectric strength and minimum 150 pound puncture resistance and 150 pound tensile strength.

Related Standard Drawing: 680-3

680.2.12 Thin Film Coatings:

Epoxy Coating for Buried Casing - Provide coating materials per AWWA C210, AWWA C213, except no coal tar epoxy will be allowed.

Epoxy Repair - Provide 100 % solids 2 component quick cure epoxy coating, NSF approved for potable water. Provide 3M Scotchkote 323 brush grade or approved equal.

Epoxy Coatings for Pipe on Bridges - Provide epoxy primer and intermediate coats with an aliphatic polyurethane topcoat. Provide Pota-Pox epoxy primer and intermediate coats and an Endura-Shield polyurethane topcoat all by Tnemec or approved equal.

Moisture Cured Urethane Coating for Pipe on Bridges - Provide a zinc and micaceous iron oxide moisture-cured urethane system. Provide an MC-Miozinc primer, an MC Miomastic intermediate coat, and a Ferrox A topcoat all by Wasser High Tech Coatings or approved equal.

Thixotropic Mastic Coating - Provide a thixotropic mastic coating for field repair of existing coal-tar enamel that is not in contact with potable water. Provide Carboline Bitumastic 50 or approved equal.

Leafing Aluminum Epoxy Coating - Provide a leafing aluminum epoxy mastic for marginally prepared surfaces. Provide Carbomastic 15 LO by Carboline or approved equal.

Galvanizing - Galvanized items shall be per ASTM A123 & ASTM A153. Provide zinc base alloys for repair per ASTM A780 - Hot stick method; zinc-rich paints are not acceptable.

Silicate Concrete Coating - Provide a water based silicate sealer for waterproofing the exterior surface of new concrete vaults.

Mortar, Grout, Grout Band - Mortar and grout shall be a chloride free Portland cement and sand mix with not less than one (1) part cement to three (3) parts sand or a proprietary cementitious chloride free mix approved in writing by the pipe manufacturer. The grout band shall physically contain the mortar/ grout and prevent moisture loss.

Backfill - Backfill in the pipe zone shall be aggregate or sand. Controlled density fill (CDF) and controlled low strength material (CLSM) are not acceptable. For tape wrapped pipe and polyethylene encased pipe, backfill shall be Class C backfill produced from crushed gravel.

680.2.13 Miscellaneous:

Pipe Hangers - All pipe hangers shall be hot-dip galvanized after fabrication.

Aluminum - Aluminum in contact with concrete or stainless steel shall be paint coated in areas of contact with a non-alkyd based paint suitable for contact with concrete.

Stainless Steel - The exposed surface of stainless steel that is in contact with DI shall be paint coated with a surface tolerant epoxy.

680.3 Construction

680.3.1 CP Test Stations

Locate test stations as follows:

Isolation Joint Test Stations (TSIJ) - Provide a test station at all buried insulated flanges and insulating couplings, except insulated connections on copper services. Provide a test station at the dielectric isolation between mortar coated steel or CCP lines and dielectrically isolated branch lines, unless the Engineer elects to not install test stations at these locations. Insulating Joint Test stations shall have two (2) AWG #8 wires welded to each side of the dielectric joint, four (4) wires total.

Casing Test Stations (TSC) - Provide one (1) test station at each end of the casing. Casing Test Stations shall have two (2) AWG #8 wires welded to the carrier pipe and two (2) AWG #8 wires welded to the casing, four (4) wires total.

Monitoring Test Stations (TSM) - Provide a monitoring test station with cathodic protection monitoring coupons where water mains cross cathodically protected foreign lines and where water mains cross electric rail tracks, and as shown on the plans for cathodically protected pipelines. Monitoring Test Stations shall have two (2) AWG #8 wires welded to the main, and two (2) cathodic protection monitoring coupons, each with two (2) AWG #12 wires, six (6) wires total.

Combination Test Stations (TSC/IJ) - When two (2) or more test stations on the same pipe are adjacent to each other (within 15-feet) they may be combined and the test wires run to a single flush mounted test station. A TSIJ near the end of a casing may be combined with the TSC into a single test station with two (2) AWG #8 wires to the casing, two (2) AWG #8 wires to the casing side of the dielectric joint and two (2) AWG #8 wires to the far side of the dielectric joint, six (6) wires total. A TSM can be included in the combined test station by providing two (2) cathodic protection monitoring coupons and the 2-inch PVC drop tube without additional wires to the pipe or casing.

Place test stations within a permanent waterline easement or dedicated public right-of-way. Test stations shall be placed in the furnishing zone at locations where the test station wiring can be bedded in the trench line of an appurtenance such as a hydrant run, a blow off, an air/vac valve, or a service line. Alternately test stations shall be placed in the pipeline trench in a City standard roadway CIV, Flush Mount Type E test station. Test stations are to be placed immediately adjacent to the pipeline or appurtenance.

Test stations shall be Type E Flush Mount CIV's unless directed otherwise by the project specifications or City Engineer.

Related Standard Drawing: 680-6 and 680-7

Post Mount Type:

Type A

Conduit shall be 2-inch in diameter and installed as shown on the applicable Standard Drawing. Install insulated bushings and throat connectors on ends of all rigid steel conduits. Install vertical steel conduit plumb and to the proper design elevation.

All horizontal conduit runs shall have a minimum cover of 24 inches. The vertical conduit runs shall be offset from over top of the pipeline but installed directly adjacent to the wire connection with pipe.

Type B

Wire shall be direct buried from the top of the pipeline to the test station with a minimum cover of 24 inches.

Install test station anchor into vertical support post and backfill, keeping station plumb.

Flush Mount Stations:

Type C

The foundation for the test station box shall be a minimum of 6-inches of class “B” backfill.

The terminal board, complete with hardware, shall be laid in the box along with 24 inches coil of slack wire.

Type D

The foundation for base of test station shall be minimum 6 inches of class “B” backfill.

Conduit shall extend into the base of the box and be trimmed smooth and flat.

Take care to install test station so that lid sets flush with finish surface.

Leave an adequate length of slack wire to allow the terminal board to be extended 24 inches from the test station base.

Type E

Install the test station in the roadway in the same manner as installing a standard valve box with cover (CIV). If the test station location is in an unpaved area provide a 24-inch x 24-inch x 6-inch concrete pad flush with grade. Leave an adequate length of slack wire to allow the terminal board to be extended 24-inches from the test station base.

Reference Electrodes

Remove any plastic shipping bag and install reference electrode 6 inches below spring line of pipe, and no more than 12 inches from outside edge of pipe. Do not place the reference cell in contact with the pipe.

Soak the reference electrode until thoroughly wetted prior to installation. Place the reference cell in the same contiguous backfill as the pipe.

680.3.2 Exothermic Welding and Underground Electrical Connections:

General - Unless otherwise specified, all electrical connections to the pipe shall be by exothermic welding or pin brazing. Where exothermic welding sleeve terminals, the sleeve flair shall be hammer die flat and the insulation cut in a manner to assure that the sleeve is properly inserted into the weld mold and to prevent lifting of the mold and leakage of weld material. Properly cover exothermic or pin brazed welds with weld caps or in the case of mortar coated steel or Concrete Cylinder pipe (CCP), tape the exposed copper of weld and wire with vinyl electric tape then encase in mortar. Provide sufficient space between adjacent exothermic welds to install a full sized weld cap on each weld. Repair all damaged pipe coating in accordance with the manufacturer's recommendations. Prior to coating, test all exothermic or pin brazed welds by striking with a hammer in a manner approved by the professional engineer or specialist in cathodic protection.

Pipe Joint Bonds - Provide pipe joint bonds to assure electrical continuity except where electrical isolation is specified. Connections to the pipe shall be by exothermic welding or by pin brazing. Bond wires shall be un-spliced wire with field connections made in the trench. Alternatively, "pig tails" can be pre-welded or pin brazed to the pipe then the pigtails spliced together in the trench with split bolt connectors. Joint bonds with lug terminals can be field connected to pin brazed threaded studs. To permit inspection of the welds and pin brazing and to prevent damage to the weld caps, apply all protective coating after the joint is in place and complete. Insulate the split bolt and all exposed copper wire by encapsulating with electrical insulation putty, Scotchfill® Insulating Putty or approved equal, molding the connection smooth, and then wrapping the connection at 50% overlap with vinyl electrical tape, Scotch Super 33 or approved equal.

Joint Bond Configuration - There shall be a minimum of 2 parallel joint bond wires, AWG #2, at each pipe joint. Valves and fittings may be bypassed by bond wires, but the valve or fitting must be made electrically continuous with the pipeline by a single wire, AWG #2 or AWG #4 that connects directly to a pipe section or connects to a joint bond wire (header run) with a split bolt connection. An assembly of valve and fittings may have a single bond wire (tap) from each component piece split bolt connected to a header run (AWG #2) that connects at each end, directly to a pipe section by exothermic weld or by split-bolt connection to a joint bond wire.

Wiring - All wiring is to be splice-free, except where splices are specified or shown or as approved. Coil or snake all buried wire with sufficient slack to prevent stress from backfill operations and earth settlement. Extend all wire at test stations a minimum of 30 inches above finished grade or install in rigid conduit. Repair any damage to the wire insulation with self-adhering butyl rubber electrical tape, Scotch No. 130C or approved equal, and over wrap with vinyl electrical tape, Scotch No. 33 or approved equal. Spirally apply each layer at 50% overlap. This repair method is not applicable to the repair of any wire in an impressed current system.

Split Bolt Connections - Split bolt connections shall be limited to the connection of two wires. Three or more wires at one split bolt are not allowed. Connection of taps to header runs may be accomplished by stripping an appropriate length of insulation from the header without cutting the wire and connecting the tap at that point with a split bolt for each tap. Insulate split bolt connections with self-fusing putty and electric tape overcoat, Scotchfill insulating putty and Scotch No. 33 electric tape or approved equal.

680.3.3 Galvanic Anode Installation

1. General - Unless specified otherwise, install anodes 5-feet below the pipe invert, positioned under the pipe or up to 3 feet perpendicular from the pipe edge. Do not place the anodes within 3-feet of a neighboring

metallic structure. When anodes are distributed along the pipeline, alternate the perpendicular offset from one side of the pipe to the other.

2. Location - Install the anode in clean, native backfill and not in the select bedding material. Locate anodes a minimum of 5-feet apart. Thoroughly soak the anode in water prior to installation. Compact the backfill to 95% of maximum density to 1 foot above the anode. Evenly distribute anodes along main and branch line installations. Anodes may be grouped at the ends of casings and short runs of pipe; maintain 5-foot minimum distance between anodes.

3. Connection - The anode lead wire shall be exothermically welded to the pipe. Alternatively the anode shall be connected to a joint bonding wire by using a split-bolt connection. Distances between anodes are nominal lengths and anode connections shall be made at pipe joints. Unless otherwise specified, for ductile iron water mains and steel pipe and casings, provide anodes as shown.

680.3.4 Dielectric Insulation

General - Provide pipe isolation with insulating flange joints, or insulating flexible couplings. Insulating joints shall be separate assemblies and not incorporated into joints with valves or other appurtenances with the exception of branch lines connected to Mortar Coated Steel Pipe (MCSP) or Concrete Cylinder Pipe. Where a branch line connects to a flange integral with a section of MCSP or CCP, a separate assembly is not required. Copper services shall be isolated with meter stops designed with integral insulation. Use insulating wall seals at all concrete wall penetrations.

Insulating joints - Mechanical joint assemblies of flange coupling adapters may be assembled above grade complete with attached test wires. Tape the flange edge of insulating joints with PVC tape to prevent particle bridging across the flange faces. Insulating flexible couplings shall have an insulating boot on each pipe end. Reducing insulating flexible couplings shall have a boot on one pipe end and restraining bolts on the other. Transition couplings are not acceptable. Use reducing couplings to accommodate differing pipe size. Joint restraint at flexible couplings shall only use hot-dip galvanized rod and nuts and shall be insulated from the non-cathodically protected side of a joint, or insulated from the mortar coated side of a joint, or insulated on one side of the joint if both sides are cathodically protected.

680.3.5 Polyethylene Encasement Sleeve Wrapped and Tape Wrapped:

Polyethylene Encasement Installation - Install polyethylene encasement, tube type, on all ductile iron pipe and appurtenances where shown or specified. Install one length of polyethylene tube encasement for each length of pipe in accordance with AWWA C105, Method A. Every 6 feet along the pipe, secure the polyethylene tube encasement with tape full circumference. The use of polyethylene sheets will not be allowed. Install 40 mil geo-membrane around mechanical joints and similar connections where the polyethylene can be punctured or ripped. Tape the ends and seams of the geo-membrane with PVC tape and then cover the pipe joint with the adjoining polyethylene encasement. Bedding and backfill around polyethylene or geo-membrane encased pipe shall be Class C backfill produced from crushed gravel.

Sleeve Wrapped Installation - Install geo-membrane when crossing a cathodically protected foreign line where the pipe configuration does not allow for a PVC pipe sleeve.

Tape Wrapped Coating for Casings - Apply tape wrapped coating on steel casing pipe in accordance with AWWA C203, AWWA C214, AWWA C216 for manufacturer applied tape wrap and AWWA C209 for minor field applications. For

tape wrapped coating repairs and other coating holdback areas, apply repair tape system per manufacturer's requirements. Apply petroleum wax tape per AWWA C217 with outer wrap only where directed.

Tape Wrapped Coating for Copper Services - Provide 20 mil PVC tape wrap and apply at 50% overlap, 40 mil total. Wrap the copper tube and all fittings including corporation and meter stop.

Mortar Coated Steel (MCSP) and Concrete Cylinder Pipe (CCP) - Transmission mains shall have continuous mortar coating over all in-line valves, fittings, and other appurtenances, regardless of underlying coating, except when the application of a dielectric coating and installation of anodes at a valve, fitting or other appurtenance is allowed in lieu of mortar coating.

Related Standard Drawing: 680-4 and 680-5

680.3.6 Thin Film Coatings

Paint for Buried Casings, Casing Welds - Provide an epoxy coating per AWWA C210 and AWWA C213. Any angle iron, c-channels, lubricating or grout pipe, fins, or other appurtenances connected to the casing shall be epoxy coated on all sides. For field repairs, prepare the surface by power tool cleaning, SSPC-SP3, and repair with a 100% solids epoxy, one coat of 25 mil dry film thickness (mdft), or when permitted, coat the weld with thixotropic coal tar mastic, one coat of 20 mdft.

Paint Coating for Pipe in Vaults and Facilities - Coat all piping except fittings and specials that are factory coated with fusion-bonded epoxy. Prepare the surface by power tool cleaning, SSPC-SP3, or shop abrasive brush blasting, SSPC-SP7, modify SSPC specifications per National Association of Pipe Fabricators, Inc., NAPF 500-03. Use a needle gun or abrasive blast to disrupt the asphaltic coating on ductile iron pipe and fittings but it is not necessary to remove all asphaltic coating. All work in vaults and facilities shall be done with HEPA filter equipment. Do not coat bolt areas such as flanges or restrained joint holdback areas until connection is complete. Coat with a leafing aluminum epoxy mastic, Carboline Carbomastic 15 or approved equal, two (2) coats minimum with 6 mdft per coat, 12 mdft total.

Steel pipe, fittings and specials, 16-inches diameter and larger, shall be shop coated, except for hold backs, prior to installation. Surface preparation shall be near white abrasive blast SSPC-SP10 and the coating shall be a leafing aluminum epoxy mastic, two (2) coats 6 mdft per coat, 12 mdft total.

Paint Coating for Pipe on Bridges - Shop blast and shop coat pipe except for hold back areas. Surface preparation and application of coatings shall be in accordance with manufacturer's written recommendations. Do not coat bolt areas such as flanges or restrained joint holdback areas until connection is complete.

1. Ductile Iron (DI) Pipe - For ductile iron pipe prepare the surface by power tool cleaning, or shop abrasive brush blasting, per National Association of Pipe Fabricators, Inc., NAPF 500-03. Use a needle gun or abrasive blast to disrupt the asphaltic coating on DI pipe and fittings, but it is not necessary to remove all asphaltic coating. Coat with a leafing aluminum epoxy mastic, Carboline Carbomastic 15 or approved equal, 2 coat minimum with 6 mdft per coat, 12 mdft total.

2. Steel Pipe - For steel pipe prepare the surface by near white abrasive blasting SSPC-SP10. Coat with:

    a. leafing aluminum epoxy mastic, 6 mdft per coat 12 mdft total, or
    b. an epoxy coating system, 3 coats of 3-4 mdft per coat, 9-12 mdft total, or
    c. a moisture-cured urethane system at 3 mdft prime coat, 3 mdft intermediate coat, and 2 mdft topcoat, 8 mdft total.

Galvanizing - Repair of galvanizing shall be per ASTM A780 using the zinc based alloys “hot stick” method. Zinc-rich paint is not permitted.

680.3.7 Testing and Verification

Quality Assurance - The portion of the work that involves the installation and testing of the galvanic cathodic protection system shall be conducted by a professional engineer regularly performing cathodic protection work or by an individual who is registered or certified by the National Association of Corrosion Engineers (NACE) as a cathodic protection specialist. Submit verification of registration or certification for written approval prior to the start of the work.

Field Verifications - The professional engineer or specialist in cathodic protection shall field verify the adequacy of the Contractor's personnel in handling and placing anodes, monitoring coupons, exothermic welding, installation of split bolt connectors, repair of coatings including weld caps, and measurements of dielectric isolation and bonding. The professional engineer or specialist in cathodic protection shall at the start of the work provide a list of qualified Contractor personnel and only these listed individuals shall perform such work for the Contractor.

Testing During Construction - Test all isolation joints after installation and prior to backfilling.

Continuity and Isolation Testing - Perform testing as follows:

1. General - Test all sections of pipeline, appurtenances, services, hydrants, regulator vaults, and appurtenances that are cathodically protected and dielectrically isolated for electrical continuity and dielectric isolation after all Contractor connections have been made.

2. Test Current Response - Measure the response of the pipe to the application of cathodic protection test current. If the application of the test current causes the pipe-to-soil potential to become more negative, electrical continuity of the pipeline, service runs, and appurtenances is indicated between that point and the point at which the test rectifier negative connection was made. The response of the potential shall be of a magnitude to demonstrate low resistance joint bonds. Electrical isolation across insulating fittings shall be indicated by the pipe-to-soil potential becoming more positive or only slightly more negative in relation to the structure connected to the test rectifier.

Lack of Continuity or Isolation - If electrical continuity or electrical isolation is not achieved, locate the deficiency and complete the necessary repairs. The engineer or specialist shall retest the system before final acceptance.

Repairs - Make all repairs necessary to correct any deficiencies and repair any joint not passing the electrical continuity or isolation test at no cost to the City.

Final System Testing - Final system testing shall be performed prior to the hydrostatic testing of each segment and prior to the substantial completion. Final testing shall be performed directly by the professional engineer or specialist in cathodic protection and witnessed by the City and shall include the following as a minimum:

1. Test and Service Locations - Provide pipe-to-soil potential measurements for all test stations and for all service connections.

2. Continuity and Isolation Measurements - Provide a report consisting of continuity and isolation measurements and other data for all cathodically protected sections of pipe, appurtenances, and for all service connections.

Documentation - Provide three (3) copies of a report documenting all testing and installation of cathodic protection system. The professional engineer shall stamp or the cathodic protection specialist shall sign the report. Include the specialist's NACE registration or certification number.

Section 690 Cross Connection Control and Backflow Prevention

690.1 General

This Chapter provides an overview of the City of Beaverton *Cross Connection Control Program.* The purpose of the Program is to protect public health by maintaining the quality of Beaverton's drinking water. Rules governing the Program are contained in City of Beaverton *Municipal Code*, and OAR 333-061-0070.

The application of the *Cross Connection Control Program* involves the installation of backflow assemblies for *premises isolation*. The Public Works Department's responsibility for cross connection control is up to the *point of delivery*; therefore, when backflow protection is required by the Public Works Department, it shall be installed at the *point of delivery* or as directed by the Public Works Department. Backflow assemblies shall be placed within the property line as close to the water meter as possible, with no connections or tee fittings between the meter and backflow assembly.

Premises isolation backflow protection is specifically for protection of the public water system. It differs in scope from backflow protection required by the *Oregon Plumbing Specialty Code (OPSC*). The protection prescribed in Chapter 6 of the OPSC is primarily for the safety of the water users within a facility. *Premises isolation* backflow protection safeguards the public drinking water supply by effectively isolating it from any contamination originating within the *premises* water distribution system.

690.2 Installation Requirements:

A plumbing permit is required prior to installing *premises isolation* backflow protection on domestic. Backflow protection for fire systems is reviewed and permitted through the Building Permit and the TVF&R Inspector.

Backflow assemblies and devices shall be installed according to the requirements set forth in OAR 333-061-0071, the OPSC and Public Works Department Standard Drawings (located in the Appendix of this Standard).

Backflow assemblies and devices shall be installed according to the requirements set forth in OAR 333-061-0071, the OPSC and Water Department Standard Drawings (located in the Appendix of this Standard).

The *backflow prevention assembly* for premises isolation is to be located immediately after the water meter on the private property side of the public right-of-way boundary. If installed underground, it shall be placed in a properly sized valve box or vault (see Standard Drawings in the Appendix). Aboveground installations shall be placed in a properly sized enclosure provided with *freeze protection* and according to the Standard Drawings in the Appendix. Fire service connections 3-inch or larger shall have a line size valve installed at the property line of the premises and shall be ductile iron pipe construction to a point which is a minimum of 5-feet beyond the downstream exterior wall of the backflow vault.

The type of *backflow prevention assembly* to be used for *premises isolation* shall be based on the actual or potential hazard within the *premises*. For example: If the *premises* contains fixtures or equipment that require a reduced pressure principle backflow assembly (RP), the City will require a RP immediately after the water meter.

690.2.1 Typical Conditions Requiring Backflow Protection

An approved, customer owned and maintained *backflow prevention assembl*y shall be installed on domestic, irrigation or fire service line(s) to *premises* when any of the following conditions exist:

1. Premises with activities included in Table 42 of OAR 333-061-0070.

2. There is an *auxiliary water supply,* such as a well, *cistern,* or body of water on the property.

3. There is intricate or inaccessible piping, which makes it impractical to ascertain whether or not a *cross-connection* exists.

4. There is an elevation difference between the service connection at the public water main and the highest water outlet on the property that exceeds 30-feet.

5. There is a risk of *backsiphonage* or *backpressure* due to practices or equipment.

6. There is an actual or potential *cross-connection* that presents a health hazard.

7. There is an irrigation system.

8. There is a water storage tank or bulk water filling station for vehicles and/or equipment.

9. There is a temporary water supply provided for construction use.

10. There is a fire line, fire sprinkler system, or private fire hydrant on the premises.

11. There are materials or chemicals on site which present a potential hazard to the water supply.

690.3 Auxiliary Water Supply:

Water customers having an *auxiliary water supply* such as a well, cistern, or body of water on site are required to have *premises isolation backflow protection.* A reduced pressure back-flow is required even if the auxiliary source is used only for irrigation purposes and no connection to the potable line exists.

Existing connections from a well or other source to the premises water piping system must be fully removed prior to turning on a newly provided service meter to new customers.

If a premises receiving City of Beaverton water has an abandoned well, a copy of the certificate of abandonment from the appropriate State or County Agency shall be provided to the City of Beaverton. Once the City of Beaverton verifies the abandonment, no backflow prevention assembly will be required at the meter unless other hazards warrant it.

690.4 Approved Backflow Prevention Assemblies and Devices, and Sizes:

A list of *backflow prevention assemblies* approved for use in Oregon is available from the Drinking Water Section of the Oregon Health Authority.

The type of *backflow prevention assembly* required is determined by the hazard level, and the potential for *backsiphonage, backpressure* or both. (See Table 49 in OAR 333-061-0070.)

Line size shall be determined by the Building Department or TVF&R Inspector.

690.4.1 Types of Assemblies and Devices

A. Air Gap (AG):

An Air Gap is the unobstructed vertical distance through free atmosphere between the lowest effective opening from any pipe or faucet conveying water to the receptacle. These vertical, physical separations must be at least twice the effective opening of the water supply outlet, never less than 1-inch above the receiving vessel flood rim.

An approved AG is required on water tank trucks that fill from Bulk Water Hydrants.

Related Standard Drawing: 690-1

B. Double Check Valve Assembly (DC):

A DC is a complete assembly consisting of two internally loaded, independently operating check valves, located between two tightly closing resilient-seated shutoff valves with four properly placed resilient-seated test cocks. This assembly shall only be used to protect against a *non-health hazard* (i.e., a pollutant).

Application examples for DCs:

- Commercial and multi-tenant buildings that do not present a health hazard
- Multi-story buildings in which the highest portion of the water piping is in excess of 30-feet above the water main at the service connection
- Restaurants or other food service establishments (caterers, kitchens, coffee shops, etc.)
- Mobile and manufactured home parks
- Premises with fire service lines, fire sprinkler systems, or private hydrants
- Premises with numerous backflow incidents as evidenced by *Automatic Meter Reading* (*AMR)* reports.

Related Standard Drawings: 690-2B, 690-3 Series, 690-4 Series

C. Double check Detector Assembly (DCDA):

A DCDA is a specially designed backflow assembly consisting of a line-size-approved double check valve assembly with a bypass containing a water meter (Neptune T-10 AMR with E-Coder)R900i) and an approved double check valve assembly. The meter shall register accurately for only very low rates of flow up to 3 GPM and shall show a registration for all rates of flow. This assembly shall only be used to protect against a *non-health hazard* (i.e., pollutant).

Related Standard Drawings: 690-5 Series

D. Reduced Pressure Backflow Assembly (RP):

Also known as a "Reduced Pressure Principle Backflow Assembly," an RP is a complete assembly consisting of a mechanical, independently acting, hydraulically dependent relief valve, located between two independently operating, internally loaded check valves that are located between two tightly closing resilient-seated shutoff valves with four properly placed resilient-seated test cocks. If either check valve leaks, the pressure relief valve maintains a differential pressure of at least 2-psi between the two check

valves, by discharging water to the atmosphere. The reduced pressure backflow assembly is designed to prevent backflow caused by backpressure and backsiphonage from low to high *health hazards*.

Application examples for the RP:

- Commercial, industrial and multi-tenant buildings that present a health hazard
- Food processing and beverage bottling including ice manufacturing plants and bottled water industries.
- Chemical plants, manufacturing plants, metal plating industries
- Industries that use heat exchangers
- Spas and pedicure salons
- Premises with boilers
- Hospitals, medical offices, dental clinics, veterinary offices, plasma centers, convalescent facilities, and other health care facilities
- Laboratories (chemical, medical, biological, environmental testing, etc.)
- Mortuaries
- Fueling (gas) stations
- Automotive service facilities
- Sewage treatment plants and sewage pump stations
- Dry cleaners and commercial laundries
- Car wash facilities
- Any water system with pumps to supplement pressure
- Premises with chemically treated fire sprinkler systems.
- Irrigation systems that contain injectors for the addition of chemicals or fertilizer
- Irrigation systems that use pumps
- Water tanker trucks or other water storage systems without a permanent air gap assembly.
- Farms, including hobby farms that use water for other than household purposes.
- Premises where both reclaimed and potable water are used
- Premises with piping under pressure for conveying liquids other than potable water and the piping is installed in proximity to potable water piping
- Premises where City staff is denied access or restricted access for survey
- Any premises or other water using activity that presents a health hazard to the public water supply.

Related Standard Drawings: 690-6, 690-7, 690-8, 690-9, 690-10

E. Reduced Pressure Detector Assembly (RPDA):

Also known as a "Reduced Pressure Principle Detector Assembly," an RPDA is a specially designed backflow assembly consisting of a line-size approved reduced-pressure principle backflow prevention assembly with a bypass containing a water meter (Neptune T-10 AMR with E-Coder)R900i) and an approved reduced-pressure principle backflow prevention assembly. This assembly shall be used to protect against a non-health hazard (i.e., pollutant) or a health hazard (i.e., contaminant). The RPDA is primarily used on fire sprinkler systems.

An RPDA will be required on the fire service line of premises that use foamite, antifreeze, or other chemicals within their fire protection system. Also, if the fire protection system has an unapproved auxiliary water supply that is connected or intended to be connected to the fire system an RPDA will be required by the Public Works Department.

Related Standard Drawings: 690-8 and 690-9

F. Pressure Vacuum Breaker Assembly (PVB) for Irrigation:

A PVB is a backflow assembly consisting of an independently operating, loaded air-inlet valve located on the discharge side of the check valve, with properly located resilient-seated test cocks and tightly closing resilient-seated shutoff valves attached at each end of the assembly designed to be operated under pressure for prolonged periods of time to prevent backsiphonage. The pressure vacuum breaker may not be subjected to any backpressure.

PVB's are to be used only when the danger of backflow is from backsiphonage. An advantage of this assembly is that only one PVB is required per irrigation system. The system cannot have pumps or possibility of backpressure after the PVB. Control valves for the irrigation system must be installed on the downstream side or after the PVB. The PVB must be installed a minimum of 12-inches above the highest point of the irrigation system that it serves and must not be placed in an area subject to flooding. Per the Oregon Plumbing Specialty Code (OPSC), the PVB is approved for high hazards.

Related Standard Drawing: 690-2A

690.5 Testing of Backflow Prevention Assemblies:

State of Oregon Administrative Rules requires *backflow prevention assemblies* to be tested at the time of installation, when repaired or moved, after any backflow incident, and at least annually thereafter. All testing must be performed by a State-certified Backflow Tester. Test reports for DCDA's and RPDA's must include the detector meter reading. Results of the test must be provided to the Public Works Department within ten (10) working days* of the test.

*The 10-day requirement is based on the State of Oregon Rules and not on financial conditions or payment arrangements between the Tester and the customer.