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# 4-1 DESIGN STANDARDS

## 4-1.01 GENERAL

No extension or modification to the City's water system shall be made without approved construction plans with the signature of the City Engineer, prepared in accordance with these Standards, *AMC*, and the *City's Water Comprehensive Plan*. All construction of system extensions shall conform to these Standards, applicable *American Water Works Association (AWWA) Specifications* and the *WSDOT/APWA Standard Specifications*.

These Standards do not include design of the City's general facilities such as wells; pump stations, storage tanks, or treatment plant. The general facilities require special design and will be reviewed and approved by the City on a case-by-case basis.

## 4-1.02 HYDRAULIC REQUIREMENTS

All water mains shall be sized following a hydraulic analysis based on flow demands and pressure requirements. The system shall be designed to maintain a minimum pressure of 20 psi at ground level along the entire distribution system under all conditions of flow. The desired working pressure in the distribution system should be approximately 50 to 80 psi, not less than 40 psi, and not greater than 125 psi. Individual pressure reducing valves (PRV) are required when the static pressure at the ground level exceeds 80 psi. Flow velocities in water mains shall not exceed 10 feet per second during the highest demand and fire flow.

Fire flow requirements shall be determined by the City Fire Chief. The available fire flow will be determined by the City's engineering staff using the water system hydraulic model.

## 4-1.03 WATER MAIN EXTENSION

### ***Residential***

It is the policy of the City that anyone who desires water services for more than one (1) single family residence, including single family and multi-family structures, must extend the City's water system to, and past, at least one full side of the property. In addition, the water mains must be installed through all internal streets; loop to all adjacent mains which will, in the City Engineer's opinion, extend past or through the property in the future; and stub to the property line where it is likely that they will be needed to connect to future mains. Depending on the property size, shape and the Water System Plan, the City may require mains to be constructed on more than one, and up to all, full sides of the property.

***Non-Residential Properties***

It is the policy of the City that anyone who desires water services to non-residential (commercial, industrial or public) property must extend the City's water system to, and past, the entire perimeter of the property and/or stub or connect to present and future mains.

The City also reserves the right to require that extra service lines be installed, at their discretion, to be used for sampling stations.

If a development is located in 2 or more pressure zones, the Developer may be required to install pressure reducing stations, isolation valves, check valves, and/or booster pump stations if required by the City Engineer.

Dead-end mains shall be minimized by making appropriate looping and tie-ins whenever practical in order to provide increased reliability of service and reduce head loss.

If the Developer's project directly benefits other property owners, the Developer may enter into a reimbursement agreement with the City per AMC 12.24.

## 4-1.04 WATER MAIN LOCATION

It is preferred that water mains and appurtenances are within the right-of-way of public streets and roads. Water mains may be installed within City easements across private properties. Water mains within public right-of-way shall be located on north and east sides of the centerlines. Water mains shall be in the shoulder of the roadway for rural roads, and approximately 6 feet from the street centerline for urban streets. See Standard Detail R-060. Exceptions to this requirement may be made in order to minimize the cutting and replacing of pavement, to avoid conflicts with other underground facilities, to permit sanitary sewers to be installed on the "low side" of streets, or for other approved reasons. As nearly as practical, mains shall be installed on a particular street with the distance from the property line and/or centerline varied as little as possible. Water mains shall not be located under or behind parking lanes, curbs, gutters, or sidewalks. Valve boxes shall be located outside the normal wheel track whenever possible.

If there is an easement across a paved area on private property the water main shall be installed in the driving lanes (not under parking stalls).

Water mains may be laid along road/street curves using pipe joint deflection whenever possible. Pipe joint deflections shall not exceed one-half of pipe manufacturer's recommended maximum deflections. Bends may be required to maintain proper water main alignment within the public right-of-way or easements.

## 4-1.05 HORIZONTAL SEPARATION

Water mains shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, septic tank and/or absorption field. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10 foot separation, the City may allow deviation on a case-by-case basis using DOE criteria. Such deviation may allow installation of the water main closer to a sanitary sewer, provided that the water main is laid in a separate trench or on undisturbed earth shelf located on one side of the sanitary sewer at such an elevation that the bottom of the water main is at least 18 inches above the top of the sewer. Water service connections and side sewers shall have minimum horizontal clearance of 10 feet unless otherwise approved by the City Engineer.

***Minimum horizontal clearances from water mains:***

| | |
|---|---|
| Cable | 5’ |
| Gas | 5’ |
| Power | 5’ |
| Storm drain | 5’ |
| Telephone, Fiber optic | 5’ |
| Sanitary Sewer | 10’ |

## 4-1.06 VERTICAL SEPARATION

Wherever practical, water mains shall cross other utilities at right angles. If this is not possible, the crossing angle shall be maintained between 45 and 90 degrees. Water mains crossing sanitary sewers shall be laid to provide a minimum vertical clearance of 18 inches between the outside of the water main and the outside of the sewer. The City prefers that the water main be above the sewer main. Where a water main crosses a sanitary sewer, one full length of water pipe shall be used with the pipe centered over the sewer for maximum joint separation. When the above conditions cannot be met, the City has the right to approve a variance, but shall require that the sewer be constructed of ductile iron pipe and be pressure tested before being activated, and/or be encased as the City deems necessary. DOE criteria will also apply.

***Minimum vertical clearances from water mains:***

| | |
|---|---|
| Cable | 1’ |
| Gas | 1’ |
| Power | 1’ |
| Storm drain | 0.5’ |
| Telephone, Fiber optic | 1’ |
| Sanitary Sewer | 1.5’ |

In cases where it is not practical to maintain this minimum separation between the water main and storm drain, the vertical clearance may be less than 6 inches and Ethafoam pads are required.

## 4-1.07 SETBACK DISTANCE FROM BUILDINGS

Water mains shall be located a minimum of 5 feet from covered parking, 10 feet minimum from building and retaining walls. A 20 foot wide minimum easement shall be provided for a water main between buildings.

## 4-1.08 WATER MAIN SIZING

Transmission mains, commercial developments, and specific areas outlined in the City's Water System Plan require 12 inch or larger water mains or as directed by the City Engineer.

The City generally does not use 10 inch pipe as water distribution mains. When serving fire hydrants and for local distribution mains in residential areas, 8 inch or larger pipe is required.

The City does not use 6 inch pipe as part of the distribution system except as fire hydrant runs (not longer than 50 feet). With the City Engineer's approval, 4 inch pipe may be used to serve water to a tract or the end of a cul-de-sac after the last fire hydrant and when no future extension is required. The length of the 4 inch water main shall not exceed 200 feet.

## 4-1.09 PIPE MATERIAL

Generally, water mains shall be cement mortar lined ductile iron pipe (DIP) Class 52 unless otherwise approved by the City Engineer.

## 4-1.10 PIPE FITTINGS

Pipe shall be furnished with mechanical joints or rubber gasket push-on joints (Tyton joint only) unless flanged joints or restrained joints are required. Horizontal or vertical bends shall be used when joint deflection would exceed one-half of the pipe manufacturer's recommended maximum deflection. Meg-A-Lugs are required on all fittings.

## 4-1.11 STEEL CASING

Ductile iron pipe shall be encased in a steel casing when crossing under a rockery or wall so that removal or replacement of the water main will not disturb the structures. Casings are required when crossing (1) under rockeries over 5 feet high; (2) under retaining wall footings over 5 feet wide; and (3) under reinforced earth retaining walls (both wall and reinforcing material). Casings shall extend a minimum of 5 feet past each edge of the structure, or a distance equal to the depth of pipe, whichever is greater. Minimum vertical clearance between the bottom of the wall or footing and top of the pipe or casing shall be 2 feet. The pipe trench at the casing shall be

backfilled with gravel backfill material when the vertical clearance is less than 3 feet.

Ductile iron pipe shall be encased in a steel casing when crossing under a railroad or State/County highway. Casings shall extend at least 6 feet past the edges of the right-of-way.

The casing pipe and carrier pipe shall be installed in accordance with the applicable Federal, State and local regulations. In the case of railroad crossings, the project shall also comply with regulations established by the railroad company.

The carrier pipe shall be supported by casing spacers. Casing spacers shall be placed under the carrier pipe to ensure approximate centering within the casing pipe and to prevent damage during installation. See City of Arlington Standard Detail W-230.

Steel casings may also be required when water mains cross creeks or wetlands.

### 4-1.12 COVER DEPTH

A cover depth of 3 feet (36 inches) above the top of water mains shall be maintained if possible. The cover depth shall not be less than 3 feet (36 inches) or more than 5 feet (60 inches) without the approval of the City Engineer.

If the water main is within the State or County right-of-way, the cover depths shall meet the requirements of the State or County.

### 4-1.13 SLOPES

Where the longitudinal slopes are 20% or greater, pipe joints shall be restrained. Anchor blocks shall be used in conjunction with joint restraint where slopes are 20% or greater. Timber baffle/hill holders shall be required on unpaved slopes that exceed 20%, maximum spacing shall be 20’ foot on center and minimum of 1 holder for each pipe length.

### 4-1.14 POLYETHYLENE ENCASEMENT

If required by the City, ductile iron pipe and fittings shall be protected by 8-mil polyethylene encasement in areas of severely corrosive soils in accordance with AWWA/ANSI C105/A21.5.

### 4-1.15 CONCRETE BLOCKING

When using horizontal and vertical concrete blocking, show locations and type of blocking on the plans. City Standard Details W-160 through W-175. Concrete blocking is required on all fittings including restrained joint fittings.

An 8 inch pipe at a vertical bend shall be restrained a minimum of 36 feet (2 joints) from each side of a bend. A 12 inch or larger pipe at a vertical bend shall be restrained a minimum of 54

feet (3 joints) from each side of a bend. No change in horizontal direction or diameter shall occur within 36 feet of the vertical bend. Special blocking or joint restraint designs may be necessary for poor soil, conflicting utility, etc.

## 4-1.16 ASBESTOS CONCRETE PIPE CROSSING

When a proposed water main crosses existing asbestos concrete (A.C.) pipe, the City shall require removal and replacement of the A.C. pipe with ductile iron pipe at the Developer's expense. The A.C. pipe to be removed shall be disposed of in accordance with the Puget Sound Air Pollution Control Agency (PSAPCA) requirements. A permit from PSAPCA to perform the A.C. pipe removal is required prior to construction drawing approval. DIP crossings shall be connected to the existing A.C. main with Romac extended range transition couplings.

## 4-1.17 VALVES

Sufficient valves shall be provided on water mains so that interrupted service and sanitary hazards will be minimized during repairs. Valves shall be located at no more than 300 foot intervals in commercial, industrial and multi-family areas and at no more than one block or 400 foot intervals in other areas. At water main intersections, valves shall be placed on 4 legs at each cross, and 3 legs at each tee (unless tapping an existing water main). The valves shall be spaced so that no more than one fire hydrant is removed from service with any separate main shut down.

An auxiliary valve shall be installed on each hydrant run at the tee. Provide a valve at each end of an easement. Additional valves may be required for area isolation and unidirectional flushing. Valves on water mains shall, where practical, be located within paved area of the street. A valve box or chamber shall be provided for every valve.

Generally valve sizes shall be the same as the water main. All valves 12 inch and smaller shall be resilient seated gate valves and all valves larger than 12 inch shall be butterfly type if approved by the City. When butterfly valves are installed, the operation nuts shall be on the north or east sides of the water mains. If a valve is installed in gravel or unpaved area, a concrete pad shall be set around each valve box at finished grade. See City Standard Detail W-190.

## 4-1.18 FIRE HYDRANTS

Fire hydrants shall be installed for buildings where water is served by the City. The final number of hydrants and their locations shall be approved by the City Fire Chief.

The maximum spacing of fire hydrants serving single-family dwellings or duplex dwellings on individual lots shall be 600 feet and not more than 300 feet from the front property line of the main body of a lot. Required distances shall be measured along the normal fire department hose laying route.

Fire hydrants serving multi-family and commercial lots shall be located not more than 300 feet on center and shall be located so that at least one hydrant is located within 150 feet of all structures or uses. Fire hydrants shall not be closer than 50 feet from multi-family or commercial buildings. On arterial streets without residential access, maximum hydrant spacing shall be 600 feet.

Any hydrant run exceeding fifty (50) feet in length shall be 8 inches in diameter unless it is approved by the City Engineer. The joints of hydrant runs shall be restrained. No domestic or fire sprinkler service shall be tapped on any hydrant run. Fire hydrants shall be installed at the ends of each dead end line more than 300 feet in length. Said fire hydrants may be removed to conform to standard spacing requirements when the main is again extended with the City's approval.

Fire hydrant installation is shown in Standard Detail W-010 and reflective pavement markers are shown in Standard Detail W-015.

## 4-1.19 COMBINATION AIR VALVES

Combination air valves as shown in Standard Detail W-260 shall be installed on high points of new water mains, where the elevation difference between the high point and the next low point exceeds one (1) pipe diameter, or as required by the City. The air valves shall be located outside the traveled portion of the roadway, preferably behind the curb or sidewalk and within the public right-of-way and the public utility easement. If possible, the water main profile shall be adjusted to eliminate the use of the air valves.

## 4-1.20 BLOW-OFFS

Each dead-end main shall be provided with a fire hydrant if flow and pressure are sufficient or with an approved flushing hydrant or a blow-off assembly shown in Standard Detail W-180 for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer. Blow-off assemblies shall be located outside the traveled portion of the roadway, behind the curb or sidewalk, and within the public right-of-way or public utility easement.

A 2 inch blow-off assembly shall be required for testing and disinfection of new water mains, where hydrants are not available.

## 4-1.21 CONNECTION TO EXISTING SYSTEM

Connections to existing water mains 8 inches and larger shall be via a wet tap shown in Standard Detail W-200 unless cut-in is required by the City in order to install additional valves. Connections to existing water mains smaller than 8 inch diameter shall be made by cutting in a tee, unless otherwise approved by the City.

## 4-1.22 EASEMENTS

All water mains, valves, fire hydrants, meters, sampling stations, air/vacuum valves, blow-offs, and other appurtenances not in public right-of-way shall have public utility easements designated on submitted plans to provide the City with permanent access to these mains and appurtenances, as well as easements for future line connections, as required. The easement for the water mains shall be 20 feet in width and 10 feet on all sides of the pipe lines, a minimum of 5 feet on each side of fire hydrants and other appurtenances (such as meters, sampling stations, air/vacuum valves, blow-offs, etc). Under special circumstances, the easement may be less than 20 feet in width with the City Engineer's approval, but shall not be less than 15 feet. Before the project is accepted by the City, easements shall be recorded using the City Easement Form. Easement drawings and legal description shall be included as exhibits.

If off-site easements are required on properties not owned by the Developer or the City, the Developer shall acquire the easements at his/her expense before construction plans are approved by the City.

## 4-1.23 SERVICE CONNECTIONS

Service connections including saddle, service line, meter box and appurtenances shall be installed as part of the construction of all new water system extensions. A fire sprinkler meter per City Standards shall be provided if required by the City Fire Chief. Irrigation systems, fire sprinkler systems and non-residential connections must be protected by a DOH approved backflow prevention assembly in accordance with WAC 246-290-490. See Standard Details W-090 through W-150.

For residential developments, meter boxes shall be located in front of the lot to be served unless otherwise approved by the City. They shall be close to the property line, in a landscape area within public right-of-way or public utility easement, but not in paved areas such as sidewalk or driveway. Meters for two neighboring lots shall be installed near the common lot line to ease meter reading. Meters located close to driveways shall use boxes with traffic rating. The distance from the water main to the meter box shall not exceed 50 feet unless it is approved by the City. Meters shall be located in or as close to the public right-of-way as possible. Service lines shall be perpendicular to the water main if possible. See Standard Details W-040 for residential services and W-050 for non-residential services.

For commercial and multi-family developments, meters shall be located behind the back of a curb or sidewalk and not behind parking space or other obstructions. Meters shall be located for ease of reading.

Minimum allowable service lines from mains to meters shall be 1 inch for a single family residential buildings and 2 inch for multi-family or commercial buildings. All duplexes and triplexes must have separate services and meters for each unit. Multifamily buildings with four or more units must have separate services and meters for each building. Each building shall be

served by a separate service and meter. Irrigation and fire sprinklers shall be served by separate services and meters unless otherwise approved by the City Engineer. A minimum pressure of 35 psi at the meter shall be maintained when service is flowing at anticipated maximum flow rates. If friction losses will cause the pressure at the building to drop below the minimum, the service line size shall be increased.

The standard meter size is ⅝ inch × ¾ inch for a single family residential house. Non-residential services and meter sizes (minimum ⅝ inch × ¾ inch) shall be determined by the engineer or architect per the Uniform Plumbing Code and approved by the City Building Official, and the plans shall show the locations and sizes of the services and meters.

Static service pressures at ground floor elevation shall be determined at all lots/buildings to ensure compliance with system pressure standards. Plans shall identify lots/buildings where the builder/owner will be required to install individual pressure reducing valve (PRV) when service pressures exceed 80 psi. A PRV shall be on the customer side of the meter, outside of the public right of way and a minimum of 3 feet after water meter box.

### 4-1.24 EXISTING WATER MAIN ABANDONMENT

Existing water mains out of service shall be removed or abandoned as required by the City. If water mains are to be abandoned, the ends of the abandoned water mains shall be plugged by filling with Class 2500 concrete for a minimum length of 12 inches.

### 4-1.25 PRESSURE REDUCING STATIONS

If a development is located in two or more pressure zones, pressure reducing stations may be installed by the Developer if required by the City Engineer.

### 4-1.26 CROSS-CONNECTION CONTROL

The City strictly prohibits interconnection of other water supplies with the City's water system.

Irrigation systems, fire sprinkler systems, commercial service connections and other water uses which may cause contamination of the City water system require a backflow prevention device to be installed. Approved backflow prevention assemblies shall meet the requirements of the WAC 246-290-490 "Cross Connection Control Regulation in Washington State", and the recommendations of the PNWS-AWWA Cross Connection Control Manual and the City of Arlington Cross Connection Control Program depending upon the degree of hazard. The types of backflow prevention devices to be used for a specific project shall be determined by the City's Cross Connection Specialist.

Fire sprinkler system connections to the City's water system shall be owned and maintained by the property owner, beginning immediately downstream of the valve where the fire sprinkler

system connects to the City's water main at the property or right-of-way line.

The backflow prevention assembly on fire sprinkler system connections shall be located as close to the serving water main as possible, either on the owner's property or in an easement.

A master meter used for eight or more units in a multi-family development, or for buildings exceeding thirty feet in height, require double check valve assemblies and a bypass with equal backflow prevention to avoid loss of service during maintenance and repair.

### 4-1.27 PRIVATE WELLS

To receive water services from the City, the property owner shall decommission the existing well on the same lot in accordance with WAC 173-160-381. The owner shall provide a copy of the decommission report to the City Utilities Division.

No backflow prevention device for a single family lot is required if the private well is verified to be permanently decommissioned.

New services will be locked until compliance is verified by the City's Cross Connection Specialist. Visual inspection of the piping is required for premises retaining active well systems.

## 4-2 MATERIAL STANDARDS

### 4-2.01 GENERAL

All materials shall be new and undamaged. The same manufacturer of each item shall be used throughout the work. All materials not specifically referenced shall comply with applicable sections of ANSI, ASTM, AWWA or the WSDOT/APWA Standard Specifications and approved by the City Engineer.

When specific manufacturers or models are specified in these Standards, no substitutions will be allowed without prior approval by the City. If required by the City, the Contractor shall furnish certification from the manufacturer of the materials being supplied that the inspection and all of the specified tests have been made and the results thereof comply with the requirements of the reference Standards.

### 4-2.02 DUCTILE IRON PIPE

Ductile iron pipe shall be Class 52 (Tyton joint only) and cement mortar lined unless otherwise specified and shall conform to AWWA/ANSI C151/A21.51. Standard thickness of cement mortar lining shall be in accordance with AWWA/ANSI C104/A21.4.

## 4-2.03 HIGH DENSITY POLYETHYLENE PIPE

High density polyethylene (HDPE) pipe shall conform to AWWA C906. The pressure rating shall be determined by the City Engineer on a case-by-case basis.

## 4-2.04 WATER SERVICE PIPE

Water service pipe shall be Driscopipe CTS Class 200 Hi-Mol Poly pipe. Driscopipe shall conform to ASTM D-27370SDR9 (PE3408). CTS 110 SS liners for polypipe shall be used.

## 4-2.05 FITTINGS AND JOINTS

All fittings for ductile iron pipe shall be ductile iron compact (short body) fittings conforming to AWWA/ANSI C153/A21.53 and shall be cement mortar lined conforming to AWWA/ANSI C104/A21.4.

Joints shall be mechanical joints or rubber gasket push-on joints (Tyton joints only) unless flanged joints or restrained joints are required and shown in the plans. Pipe with push-on joints shall be suitable for use with mechanical joint fittings. Ductile iron pipe fittings shall be pressure rating of 350 psi for push-on or mechanical joint fittings and 250 psi for flange joint fittings drilled in accordance with AWWA/ANSI C111/A21.11, unless otherwise noted.

Rubber gaskets for push-on joints (Tyton joint only) or mechanical joints shall be in accordance with AWWA/ANSI C111/A21.11. Gasket material for flanges shall be neoprene, Buna N, chlorinated butyl, or cloth inserted rubber.

## 4-2.06 RESTRAINED JOINTS

Where restrained joints are required, they shall be either bolted or boltless design, flexible after assembly, and can be disassembled without special tools. Any device utilizing round point set screws shall not be permitted. All couplings installed underground to connect ductile iron pipe shall be manufactured of ductile iron.

Restrained joints shall be Meg-A-Lug Series 1100, TR Flex, Grinnell 595 shackle clamp, or approved equal.

## 4-2.07 COUPLINGS

Flexible coupling and transition coupling cast components shall be ductile iron. Bolts and nuts shall be in accordance with ASTM A536-80, Grade 65-45-12. Bolts shall be high strength, low alloy steel track head bolts with national course rolled thread and heavy hex nuts. Gaskets shall meet AWWA/ANSI C111/A21.11 composition specifications.

## 4-2.08 BOLTS AND NUTS

Bolts, nuts and washers used for securing fittings shall be of similar materials. Steel bolts shall meet the requirements of ASTM A307 or ASTM F568 for carbon steel or ASTM F593 or ASTM F738 for stainless steel. Nuts shall meet the requirements ASTM A563 for carbon steel or ASTM F594 or ASTM F836 for stainless steel. Iron bolts and nuts shall meet the requirements of ASTM A536, grade 65-45-12.

## 4-2.09 GATE VALVES

All gate valves 12 inches and smaller shall be resilient seated gated valves conforming to the latest revision of AWWA C509 or C515. All gate valves shall be epoxy coated and turn counter clockwise to open. All gate valves shall have ANSI flanges or mechanical joints ends.

Buried gate valves shall be non-rising stem suitable for installation with the type and class of pipe being installed. Operating stems shall be equipped with standard 2 inch operation nut, and O-ring stem seals.

## 4-2.10 VALVE MARKER POSTS

Valve marker posts shall be Carsonite blue plastic markers and labeled "WATER" or approved equal. See City Standard Detail W-250.

## 4-2.11 VALVE BOXES

Valve boxes shall be installed on all buried valves. The box and lid shall be cast iron, 2 piece slip type. The cover shall have the word "WATER" cast in the upper surface. Valve boxes, lids and extensions shall be Olympic Foundry deep style lid. All castings shall be coated with asphaltic varnish.

A valve operating nut extension shall be furnished and installed on all valves where the finished grade is more than 36 inches above the valve operating nut. Extensions are to be a minimum of 12 inches long with only one extension per valve. The operating nut extension shall extend into the top section of the valve box. See Standard Detail W-190.

## 4-2.12 VALVE VAULTS

The valve vault shall be dimensioned and sized for valve removal and replacement. The vaults shall be furnished in pre-cast concrete sections with sufficient strength to withstand H-20 traffic loading together with access frames and covers.

## 4-2.13 COMBINATION AIR VALVES

Combination air valves shall be designed to operate with potable water under pressure to permit discharging a surge of air from an empty line when filling and relieve the vacuum when draining the system. The air valves shall also release an accumulation of air when the system is under pressure. This shall be accomplished in a single valve body designed to withstand a pressure of 300 psi.

The body and cover shall be cast iron conforming to ASTM A48, Class 30. Floats shall be stainless steel conforming to ASTM A 240 and designed to withstand 1,000 psi. Seats shall be Buna N rubber. Internal parts shall be stainless steel or bronze. Combination air valves shall conform to AWWA C512. See City of Arlington Standard Detail W-260.

## 4-2.14 BLOW-OFF ASSEMBLIES

Blow-off assemblies shall be as shown in City Standard Detail W-180.

## 4-2.15 FIRE HYDRANTS

Fire hydrants shall be 5 ¼ inch MVO and meet or exceed the requirements of AWWA C502 as well as the following:

1) Hydrant shall have a standard 4½ inch NST pumper port and two 2½ inch NST side ports, all opening by turning counter clockwise with 1½ inch operating nut;

2) Hydrant shall be painted with two coats of hi-gloss equipment yellow enamel paint, with the distance from the foot valve stenciled on the hydrant; and

3) 5" Storz adaptor.

Fire hydrants shall be the "Traffic Model" type with approved breakaway features. Fire hydrants shall be M&H 929 Reliant or Mueller Super Centurion 250 only.

## 4-2.16 TAPPING SLEEVES

Tapping sleeves shall be used in lieu of cut-in tees except at the direction of the City. Tapping valves shall be epoxy coated and resilient seat. Acceptable sleeves include:

| **Pipe Material** | **Type of Tapping Sleeve** |
|---|---|
| Ductile Iron or Cast Iron Pipe | Epoxy Coated Fabricated Steel |
| Asbestos Cement | Fabricated Stainless Steel Full |

## 4-2.17 SADDLES AND CORPORATION STOPS

Service saddles shall be ROMAC 202S and shall have stainless steel double straps. See Standard Details W-040 and W-050

Corporation stops shall be the ball valve type and shall be Ford or Mueller. Corporation stops for use with the saddle shall be of bronze in accordance with AWWA Standard C800 with AWWA IP or CC inlet by compression outlet.

## 4-2.18 METER BOXES

Meter boxes used for meters, sampling stations, and blow-offs shall be high density polyethylene meter boxes with solid ductile iron lids manufactured by Mid States Plastics, Inc., or approved equal. Air valves shall have double concrete meter boxes Fogtite 2T with solid steel lid. Refer to City Standard Detail W-040 and W-050 for sizes and part numbers.

## 4-2.19 PRESSURE REDUCING STATION

The Developer's Engineer shall design a pressure reducing station for a specific project. Submit to the City for approval. A typical pressure reducing station is shown in City Standard Detail W-080.

## 4-2.20 REDUCED PRESSURE BACKFLOW ASSEMBLY

All reduced pressure backflow assemblies (RPBA) shall be as listed on the current copy of the "Approved Backflow Prevention Assemblies" published by DOH. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks. The RPBA shall be installed in an above ground enclosure. The enclosure shall be Hot Box, or approved equal. See Standard Details W-130 through W-150.

## 4-2.21 DOUBLE CHECK VALVE ASSEMBLY

All double check valve assemblies (DCVA) shall be as listed on the most current copy of the "Approved Backflow Prevention Assemblies" published by DOH. The assembly shall include a tightly closing resilient seated shut-off valve on each end of the body and each assembly shall be fitted with four properly located resilient seated test cocks. See Standard Details W-090 through W-120.

## 4-2.22 STEEL CASING

Steel casing shall be black steel pipe conforming to ASTM A53. Casing shall be as specified in City Standard Detail W-230.

### 4-2.23 CASING SPACERS AND END SEALS

Casing spacers and end seals shall be sized for pipe being installed and shall be manufactured by Advance Products & Systems, Cascade Waterworks, Pipeline Seal and Insulators Co., or approved equal.

### 4-2.24 CONCRETE

Thrust blocking, encasement, or slope anchor concrete shall be mixed from materials acceptable to the City and shall have a 30-day compressive strength of not less than 2,500 psi.

The mix shall contain five (5) sacks of cement per cubic yard and shall be of such consistency that the slump is between 1 inch and 5 inches. All concrete shall be mechanically mixed.

### 4-2.25 BEDDING MATERIAL

Select trench backfill shall be as specified in Section 9-03.12(3) "Gravel backfill for Pipe Zone Bedding" of the WSDOT/APWA Standard Specifications.

### 4-2.26 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) shall be a mixture of Portland Cement, admixture (optional), FlyAsh, aggregates and water. It shall be proportioned to provide a grouty, non-segregating; free flowing, self-consolidating and excavatable material that will result in a non-settling fill which has measurable unconfined compressive strength.

Controlled Density Fill (CDF) shall conform to the requirements of Section 2-09.3(1)E of the WSDOT/APWA Standard Specifications.

## 4-3 CONSTRUCTION STANDARDS

### 4-3.01 GENERAL REQUIREMENTS

All work shall be constructed as shown in the plans and in accordance with these Standards.

Materials shall be installed in compliance with the manufacturer's instructions and specifications, except where a higher quality of workmanship is required by the plans and these Standards. All work shall be in accordance with any applicable regulations of the State, County and local jurisdictions. The Contractor shall arrange for inspection by these agencies and shall submit evidence of their approval, if requested by the City.

## 4-3.02 MATERIAL SUBMITTALS

The Developer/Contractor shall provide material submittals to the City for approval after the plans are approved for construction. The Developer shall assume the risk for material or equipment, which is fabricated or delivered prior to the City's approval of material submittals.

Five (5) sets of material submittals are required. The City shall either approve or otherwise indicate the reasons for disapproval. Disapproved submittals shall be resubmitted to the City for approval.

The City's review of material submittals covers only general or conformance to the plans and these Standards. The Developer is responsible for quantity determination. No quantities are to be verified by the City. The Developer is responsible for any errors, omissions or deviations from the contract requirements. Review or approval of submittals by the City does not relieve the Developer from his obligation to furnish required items in accordance with the plans and these Standards.

Each "Material Submittal" section shall follow a cover page and state the category of the materials for this section. Each submittal must have the specific part number(s) checked or highlighted along with its specific purpose. The following shows the preferred order to list the material categories:

1) Pipe, Fittings, Pipe Restraints and Casing.

2) Valves (Gate Valves, Air Valves, Blow-off, and Valve Boxes).

3) Hydrants and Attachments.

4) Service Fittings, Service Pipe, Saddles, Ball Valves, Corps, Sleeves, etc.

5) Boxes for Meters, Sampling Stations, Blow-offs, and Air Valve Assemblies.

6) Cross Connection Control Assemblies (DCDA, RPBA, RPDA, DCVA).

7) Bedding Material with Sieve Analysis.

8) Other items if required.

## 4-3.03 PRE-CONSTRUCTION CONFERENCE

The Developer/Contractor shall contact the Public Works Department (360-403-3500) to schedule a pre-construction conference after the material submittals, grading, and right-of-way permits are approved. The conference shall include the Developer, Developer's Engineer, and Contractor, representatives from the permit agencies, other utility companies, and City staff. An

on-site tailgate meeting between the Contractor and the City Inspector shall be arranged by the Contractor at least 48 hours prior to commencing construction.

## 4-3.04 CONSTRUCTION SCHEDULE

The Developer/Contractor shall provide the City with the construction schedule a minimum of five (5) business days prior to start of water system extension construction to arrange staking inspection and to give permitting agencies and customers two (2) business days notice. No construction is allowed until the construction plans have been approved and all appropriate permits have been obtained.

## 4-3.05 EASEMENT

Prior to start of water system extension construction, the Developer must acquire public utility easements for construction of any water mains or facilities not located in the public right-of-way, in City easements, or on the Developer's property.

## 4-3.06 PERMITS

All public right-of-way permits for the water system extension shall be obtained by the Developer at their expense. The Developer shall provide the traffic control plan prepared by the Developer, Developer's Engineer, or Contractor. The Developer shall apply for and obtain permits from other agencies listed in Section 1-4.04 of these Standards.

## 4-3.07 HANDLING OF PIPE

All types of pipe shall be handled in a manner that prevents damage to the pipe, pipe lining or coating. Pipe shall be bagged or plugged from the manufacturer or supplier before unloading at the site. Pipe and fittings shall be loaded and unloaded using forks or cable choker in a manner to avoid shock or damage, and under no circumstances shall they be dropped, skidded, or rolled against other pipe. Damaged pipe will be rejected, and the Contractor shall immediately place all damaged pipe apart from the undamaged pipe and shall remove the damaged pipe from the project site within 24 hours.

Pipe shall be stacked in such a manner as to prevent damage to the pipe, to prevent dirt and debris from entering the pipe, and to prevent any movement of the pipe. The bottom tiers of the stack shall be kept off the ground on timbers, rails or other similar supports. Pipe on succeeding tiers shall be alternated by bell and plain end. Timbers of 4"×4" shall be placed between tiers and chocks shall be placed at each end to prevent movement. Each size of pipe shall be stacked separately.

Threaded pipe ends shall be protected by couplings or other means until the pipe is installed. Dirt or other foreign material shall be prevented from entering the pipe or pipe joints during handling and installation. When pipe installation is not in progress, the open ends of the pipe

shall be closed by a watertight plug or by other means approved by the City to ensure cleanliness inside the pipe.

## 4-3.08 STAKING

Staking shall be performed by or under the direct supervision of the Developer's Land Surveyor licensed in the State of Washington. Provide the City with two (2) business days notice to inspect construction staking before construction begins.

Staking shall be placed in 50 foot intervals and at all fittings on base line or edge of easement with stationing, hub elevations, and cuts to top of pipe.

## 4-3.09 DEVIATION FROM PLANS

No deviations from the approved plans and these Standards shall be allowed without the City's approval. Minor changes may be approved by the City Engineer. If major changes are required, the Developer's Engineer shall revise and sign the plans for the City Engineer's approval prior to restart of construction.

If the City is aware of any deviation from the approved plans and determines that it is not acceptable, the City shall give a written notice to the Developer. The project will not be accepted unless the deviation is corrected.

## 4-3.10 INSPECTION AND TESTING

The City Inspector shall have access to the project site for the purpose of inspections and testing at all times. The Contractor shall provide proper facilities for such access, inspection, and testing.

If any work is covered without approval or consent of the City Inspector, it must be uncovered for inspection if required by the City Inspector.

Before a pressure test is to be observed by the City Inspector, the Contractor shall make whatever preliminary tests to ensure that the material and/or equipment are in accordance with the plans and these Standards.

Written and/or verbal notices of deficiency shall be given to the Contractor. The Contractor shall correct such deficiencies before final inspection by the City Inspector.

## 4-3.11 WATER QUALITY

The Contractor is required to implement water pollution controls and maintain these until the project is accepted by the City. The Contractor shall familiarize themselves with the requirements of DOE and other regulatory agencies having jurisdiction over such matters.

Water with chlorine residual must be dechlorinated using City approved means and discharged into the environment when the water has zero chlorine residual. Dechlorinated water discharged into the environment shall be done so without causing erosion or impact to the environment. With the approval of the Utilities Manager, water with chlorine residual may be discharged into the City's sanitary system. Water containing chlorine residual shall not be discharged into the storm drainage system or any waterway.

The oil and chemical storage site shall be approved by the City and the area shall be diked. There shall be no disposal of waste oil or oil products on the project site. The Contractor shall provide a waste oil disposal tank if needed.

## 4-3.12 CONSTRUCTION ON EXISTING EASEMENTS

All work on the public utility easements shall be performed in accordance with easement provisions. Easements shall be restored equal to or better than the original conditions. The Contractor shall not work on easement areas until specifically authorized by the City Engineer. The City and the Contractor shall coordinate with the property owner(s).

## 4-3.13 PRE-CONSTRUCTION PHOTOS

Before commencing any construction work as described in the plans, the Contractor shall provide photographs of pre-existing conditions of the area that will be disturbed during construction operations. Photographs will be obtained as follows:

1) 50 foot interval in easements up station and down station.

2) Any other locations as directed by the City Inspector.

The photographs shall be 5 inch x 7 inch, color prints, contained in albums, catalogued, and cross-referenced. A digital copy shall also be provided by the Contractor.

## 4-3.14 UNDERGROUND UTILITIES

The plans show the approximate locations of various existing utilities known to the Design Engineer such as gas lines, water mains, storm drainage, power lines, telephone lines, TV cables, fiber optics, and other obstructions based on information obtained from various sources. This information is not guaranteed to be accurate, and the Contractor is responsible to check for interferences and obstructions by inquiry from the different utilities and by underground exploration before commencing excavation.

The Contractor shall request field locating and notify the owners of underground utilities about the scheduled commencement of excavation through the one-call system (1-800-424-5555). If the utilities are not included in the one call number system service, notice shall be provided

individually to those owners of underground utilities known to or suspected of having underground utilities within the area of proposed excavation.

Notice shall be made to owners of underground utilities not less than two (2) business days or more than ten (10) business days prior to scheduled date of commencement of excavation.
Test pits, for the purpose of locating underground utilities or structures in advance of the construction, shall be excavated and backfilled by the Contractor. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the applicable agency.

The Contractor shall excavate around and under active utilities with special care and shall support and maintain them in service. Where it is necessary to cut, move or reconnect any service lines, arrangements shall be made with the respective utility owners.

The Contractor shall coordinate with utility owners, arrange for the movement or adjustment, either temporary or permanent, and notify the City, in advance, of any conflicts affecting the work schedule, and/or possible cost increase to the City if the project is a City capital improvement project.

The Contractor shall be responsible for any damage of utilities or services resulting from his operations and shall hold the City harmless from any claims resulting from disruption of service or damage to utilities.

## 4-3.15 TRENCH EXCAVATION

**Trench excavation and backfill operations within State right-of-way:** All excavation and backfill within the State right-of-way shall adhere to the *WSDOT/APWA Standard Specifications*.

**Trench excavation and backfill operations within County right-of-way:** Excavation within Snohomish County right-of-way shall conform first to Snohomish County Road Standards, and secondly to *WSDOT Standards.*

**Trench excavation and backfill operations within City right-of-way:** Excavation within the City right-of-way shall conform to these Standards.

Clearing and grubbing limits may be established by the City or governing agency for certain areas and the Contractor shall confine his operations within those limits. Debris resulting from the clearing and grubbing shall be disposed of by the Contractor.

Trenches shall be excavated to the line and grade shown in the plans or designated by the City. Where higher pressure class pipe or special bedding is required because of excess trench width, it shall be furnished.

Unsuitable material below the depth of the bedding shall be removed to the extent approved by the City Inspector and replaced with satisfactory materials as determined by the City Engineer.

The length of trench excavation in advance of pipe laying shall be kept to a minimum and shall not exceed more than 100 feet without written approval of the City Engineer.

When trenching operations take place in the public right-of-way, the pavement and all other improvements shall be restored as required by the right-of-way permit.

When excavation of rock is encountered, all rock shall be removed to provide a clearance below and on each side of all pipe, valves, and fittings of at least 6 inches for pipe sizes 24 inches or smaller and 9 inches for pipe sizes 30 inches and larger. Material removed shall be replaced with appropriate backfill material, which shall be compacted to 95% standard proctor. See City of Arlington Standard Detail W-270.

## 4-3.16 SHEETING AND SHORING

The Contractor shall provide and install sheeting and shoring as necessary to protect workers, the work and existing utilities and other properties in compliance with OSHA and WISHA requirements. All sheeting and shoring above the pipe shall be removed prior to backfilling. Sheeting below the top of the pipe may be cut off and left in place. Removal of the sheeting and shoring shall be accomplished in such a manner that there will be no damage to the work or to other properties.

## 4-3.17 TRENCH DEWATERING

The Contractor shall maintain sufficient pumping equipment on the project site to keep the trench free from standing water. Surface runoff shall not be allowed to flow to the trench. The trench water or other deleterious materials shall not be allowed to enter the pipe at any time. If water is found to be entering the new water main at any time, the Contractor shall plug the water main and cease working until the trench water is completely pumped out or otherwise controlled, to the satisfaction of the City Inspector. Dewatering and its methods shall be the responsibility of the Contractor. Any method used must be in accordance with the specifications and requirements of the City and DOE.

## 4-3.18 PIPE BEDDING

Bedding material, when specified or required by the City, shall be as specified in these Standards and *WSDOT/APWA Standard Specifications*. For the type of pipe (rigid or flexible) to be installed, pipe zone bedding is defined as 6 inches below the pipe and around the pipe, and 12 inches above the pipe. Native material may be used for bedding of ductile iron pipe if judged to be suitable by the City Engineer. Gravel backfill for pipe zone bedding shall be select granular material free from wood waste, organic material, and other extraneous or objectionable materials and shall have a maximum dimension of 1½ inches. Pipe zone bedding up to 12 inches over the

top of the pipe shall be evenly and carefully placed. Gravel backfill for pipe zone bedding shall be compacted to 95% maximum dry density per ASTM D1557 by approved methods (hand-held tools), so as to provide firm and uniform support for the full length of the pipe, valves, and fittings. See City of Arlington Standard Detail W-270.

## 4-3.19 CONCRETE THRUST BLOCKING

Bends, tees, plugs, reducers, and caps, unless otherwise specified, shall be blocked in accordance with the City Standard Details W-160 and W-170. All poured in place blocking shall have a minimum measurement of twelve inches 12 inches between the pipe and the undisturbed soil. Concrete blocking shall have a minimum of ¼ square foot bearing against the fitting. The Contractor shall install blocking which is adequate to withstand full test pressure as well as to continuously withstand operating pressure under all conditions of service. All concrete shall be 2,500 psi minimum and mechanically mixed.

Blocking shall, unless otherwise shown or directed, be placed so that pipe and fittings will be accessible for repair. Eight-mil polyethylene sheets shall be installed around all fittings and all bolts, nuts, and glands for future dismantling.

In the event of a shut down where time does not permit the proper setting of the concrete blocking, ecology blocks shall be installed with concrete poured around the connection point of the fitting and the blocks with the approval of the City Inspector.

## 4-3.20 TRENCH BACKFILL AND COMPACTION

Trench backfill shall be done above the pipe zone bedding. All backfill material shall be free from cinders, ashes, refuse, vegetable or organic material, boulders, rocks or stones, frozen soil, or other unsuitable material. Trench backfill material shall be as specified in these Standards and *WSDOT/APWA Standard Specifications.*

Compaction of the backfill shall, at the minimum, be accomplished by mechanical tamper, by vibrating, by rolling, or by a combination of these methods, as approved by the City Engineer. Water settling is not permitted. The Contractor shall provide the services of a testing laboratory acceptable to the City to perform on-site density tests to show that the specified density has been obtained. The approval of the compaction method and the achievement of the specified density shall, in no way, relieve the Contractor of responsibility for all repairs caused by settlement of the backfill prior to acceptance and during the two year period after acceptance of the project.

Prior to backfilling, form lumber and debris shall be removed from the trench. Sheeting used by the Contractor shall be removed just ahead of the backfilling. Backfill shall not be deposited in the trench in any manner, which will damage or disturb the pipe or the initial backfill. Care shall be taken to prevent any damage to the pipe or its protective coating. After the initial backfill is placed, the remaining backfill material shall be placed in successive layers not exceeding 1 foot, (12 inches) in loose thickness, and each layer shall be compacted to the density specified below.

Asphalt pavement restoration shall either be by a patch or overlay method as required and noted on the right-of-way permit. When a patch method is used, the trench limits shall be saw cut prior to the final patch.

All pavement cuts shall be made by saw cuts. The saw cuts shall be 1 foot outside the trench width. If the permit requires an overlay, then the Contractor may use a jackhammer for cutting the existing pavement. Grinding may be required.

All trenching shall be backfilled in accordance with the City Standard Detail W-270. All trench backfill materials shall be compacted to 95% maximum dry density, as determined by ASTM D1557.

If the City and permitting agency determine that native material is suitable for backfill, the Contractor may use the native material.

When the trench is perpendicular to the traveled lane or any driveways, the full depth shall be backfilled with crushed surfacing top course material. When the trench is parallel, the top 4 feet must be backfilled with crushed surfacing top course material. Controlled Density Fill (CDF) may be required by the City or the permitting agency.

Backfill compaction shall be performed in 8 to 12 inch lifts. The Contractor shall perform compaction tests in 4 foot vertical increments maximum. The test results shall be given to the City for review and approval prior to paving. Tests shall be performed at maximum intervals of 50 feet along the length of the trench.

If the area is unpaved and not subject to vehicle traffic, the backfill shall be compacted to a minimum of 90% of maximum dry density as determined by ASTM D-1557.

## 4-3.21 LAYING DUCTILE IRON PIPE

Work shall be accomplished in accordance with AWWA C600 and the manufacturer's recommendations.

Depths of pipe shall conform to approved plans. The typical cover depth of pipe is 3 feet (36 inches) measured from finished grade to top of pipe.

The bottom of the trench shall be finished to grade in such a manner that the pipe will have bearing along the entire length of the barrel. Bolts on mechanical pipe and fittings shall be tightened uniformly with a "Torque" wrench which measures the torque for mechanical joints as follows:

| | |
|---|---|
| 2 inch to 3 inch pipe sizes ⅝ inch bolts | 40 to 60 foot pounds |
| 4 inch to 24 inch pipe size ¾ inch bolts | 60 to 90 foot pounds |

Except where restrained joint systems are required, mechanical or push-on Tyton joints shall be used. Installation of push-on joint pipe shall be in accordance with the manufacturer's instructions.

When it is necessary to deflect pipe from a straight line in either the horizontal or the vertical plane, the amount of joint deflection shall not exceed one half ( ½ ) of the maximum deflection recommended by the pipe manufacturer. The Contractor shall submit to the City the pipe manufacturer's joint deflection recommendations prior to pipe installation as a part of the Material Submittals.

Where field conditions require deflection or curves not anticipated on the plans, the City will determine the methods to be used.

Whenever it becomes necessary to cut a length of pipe, the cut shall be done in conformance with all safety recommendations of the cutting equipment manufacturer. Cutting shall be done in a safe manner without creating damage to the pipe or cement mortar lining. The cut shall be made by an abrasive pipe saw or an approved pipe cutter.

The outside of slip joint pipes shall be beveled and smoothed so that good connections can be made without gasket damage.

All parts of the pipe ends, couplings, fittings and appurtenances shall be cleaned to remove oil, grit, or other foreign matters from the joints. Care shall be taken to keep the joints from contacting the soil.

## 4-3.22 POLYETHYLENE ENCASEMENT

Installation of polyethylene encasement shall be in accordance with the latest AWWA Standard C105. All ductile iron pipe and fittings installed in highly corrosive soils, as directed by the City Engineer, shall be wrapped except as specifically excluded in the plans or in these Standards.

## 4-3.23 FIRE HYDRANT INSTALLATION

Fire hydrants shall be set as shown in the City Standard Details W-010 through W-030 and AWWA Standard C600. The portion of the hydrants above the ground shall be painted with 2 coats of high gloss equipment yellow paint. The entire hydrant run shall be restrain jointed.

All hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the curb or at the City Fire Chief's discretion, with pumper nozzle facing the curb. Hydrants shall be set to the established grade. Hydrants shall be installed so that the breakaway flange is 2 inches

above finished grade.

When a dry barrel hydrant is set, drainage shall be provided at the base of the hydrant by placing 1½ inches of washed drain rock from the bottom of the trench to at least 12 inches above the drain port opening in the hydrant and to a distance of 2 foot around the elbow. Fire hydrants shall not be located within 10 feet horizontally of a sanitary sewer main or side sewer.

When a hydrant is installed in an unpaved area, a minimum of 3 feet × 3 feet × 4 inch concrete pad shall be poured 2 inches below the breakaway flange around the hydrant barrel to provide adequate resistance to avoid transmitting shock moment to the lower barrel and inlet connection in the case of vehicle impact. The center of the hydrant shall be at the center of the concrete pad. Prior to pouring concrete, the ground shall be compacted according to the section of Trench Backfill and Compaction in these Standards. See Standard Detail W-010.

Additional information regarding placement of hydrants can be found in AWWA Manual M17.

When fire hydrants are located in parking lots, or other areas where permitted speed limits do not exceed five miles per hour, hydrant guard posts shall be installed where the hydrant is not protected by a cement concrete curb (or extruded curb per Standard Details) on all sides where vehicles may have access. Guard posts shall be installed according to the minimum dimensions shown in the City Standard Detail W-030. Fire hydrants located in undeveloped or rural areas must have City of Arlington standard hydrant locks installed by the Developer.

Reflective pavement markers for fire hydrants are required and shall be installed per Standard Detail W-015.

## 4-3.24 VALVE INSTALLATION

Prior to installation, valves shall be inspected for approved part numbers/manufacturers; cleanliness of valve ports especially seating surfaces, handling damage, and cracks. Defective valves shall be rejected.

When butterfly valves are installed, the operation nuts must be on the north or east sides of the water mains or as directed by the City Inspector.

The valve and valve box shall be set plumb and centered on the valve. Valves 12 inches or larger shall be supported by a concrete block (16 inches x 16 inches x 4 inch solid concrete) on a sufficiently tamped trench bottom so that the pipe will not be required to support the weight of the valve. In no case shall valves be used to bring misaligned pipe into alignment during installation. Pipe shall be supported in such a manner as to prevent stress on the valve.

Valves shall be installed in the closed position. Where the valve operating nut is more than 3 feet below finished grade, a valve stem extension conforming to the Standard Details must be installed. See City Standard Detail W-190. Tapping valves shall be water tested prior to tapping

water main.

A valve box or vault shall be provided for every valve. Valve box top sections shall be adjusted flush with the finished pavement and, in those areas to be excavated for future roadway grades, enough adjustment shall be provided in the valve box to allow the top of the box to be adjusted to the required grade.

Backfill around valves shall be carefully tamped in 6 inch lifts for the full depth of the trench with the valve box in place. Provide a minimum of 2 feet x 2 feet x 4 inch concrete pad for a single valve box and a minimum of 4 feet x 4 feet x 4 inch concrete pad for multiple valve boxes installed in gravel or unpaved areas as shown in Standard Detail W-190.

## 4-3.25 COMBINATION AIR AND VACUUM RELEASE VALVE

Location of the air/vac shown in the plans is approximate. The Contractor shall set the air valves at the high points of the water main. The water main profile may need adjustment so that the high point and air/vacuum valve is installed in a convenient location with the City Inspector's approval. Installation shall be as shown in City Standard Detail W-260.

## 4-3.26 BLOW-OFF ASSEMBLIES

Blow-off assemblies shall be installed as shown in City Standard Detail W-180. A valve marker post shall be installed when the gate valve is installed in unpaved area or as directed by the City Inspector.

## 4-3.27 VALVE MARKER INSTALLATION

Marker posts shall be set for all valves located in unpaved areas and as directed by the City except auxiliary hydrant valves. Installation shall be as shown in City Standard Detail W-250.

## 4-3.28 SERVICE LINES

***New Service Installations***

Generally, corporation stops are located at ten o'clock or two o'clock positions on the circumference of the pipe, and may be screwed directly into the tapped and threaded main without any additional appurtenances if the pipe diameter is 8 inches or larger, ductile iron pipe with a thickness of Class 52 or higher. Taps may be installed with double strap stainless steel saddles. When more than one tap in an existing cast iron pipe is necessary to deliver the required flow, the taps should be staggered around the circumference at least 12 inches apart (not in line). Service line must be pressure tested before placing in service. Corporation stops with IPT threads are not acceptable, unless approved by the City or are used on large taps. Service installation shall be as shown in City Standard Details W-040 through W-070.

***Reconnecting Existing Services***

Service connections shall be installed as shown in the approved plans and Standard Details. Install services in paved areas by boring and under sidewalks and curbs by boring and tunneling. Damages shall be repaired by the Contractor. Provide 30 inch minimum cover on service lines. Install service lines at 90 degrees horizontally to the main to intercept the existing meters. Flush the service line prior to connection to the meter.

Install angle ball meter valves, setters (if required) and boxes as shown in City Standard Details W-040 and W-050 or as directed by the City.

Existing service connections shall not be transferred to the new mainline until the new mainline has been successfully flushed, disinfected, tested and approved by the City Inspector. When transferring services from the existing mainline to the new mainline, the Contractor shall take sanitary precautions to protect the potable water supply in both the existing and new mains.

## 4-3.29 PRESSURE REDUCING STATION

Installation shall be as shown in City Standard Detail W-080, in approved plans, and in accordance with the manufacturer's recommendations. The pressure reducing valves, strainers, pressure relief, pipe and fittings shall be constructed in accordance with the applicable AWWA and Uniform Plumbing Code requirements. Pressure reducing valves 6 inches or larger shall be supported by pipe supports. Supports shall be bolted to the vault floor.

Pressure relief discharge pipe shall be placed in a location that will not be subject to damage or erosion during discharge of water. The Contractor shall schedule and perform a start-up with the presence of the PRV manufacturer's representative(s).

## 4-3.30 CONNECTION TO EXISTING WATER MAIN

Points of connection to existing water mains shall be exposed prior to trenching of the new mains, and not less than 48 hours prior to the anticipated connection time. Unless specifically provided for elsewhere in these Standards, the Contractor is responsible for giving at least five (5) business days notice to the City. The City shall be responsible for notifying the City Fire Chief and customers affected by the shut-off. Water main shut-off shall not be scheduled to take place on Fridays, or on the day before a holiday, unless otherwise approved by the City Engineer.

The Contractor shall ensure that existing fittings are in accordance with the approved plans and that the connection will be made in accordance with the plans. The Contractor shall immediately notify the City Engineer and the Design Engineer if the connection cannot be made in accordance with the plans so that the connection details may be revised and approved by the City Engineer.

Connection to the existing water system shall be done only after the new mains are flushed and have passed pressure and purity tests. All connections to the existing water system must be approved by the City and in the presence of the City Inspector. Only authorized City representatives shall operate the valves in the existing water system.

Connections to existing water system may be made under pressure with a tapping machine by determining the size and type of pipe and installing a tapping tee with a tapping gate valve. Tapping tees shall be installed as shown in City Standard Detail W-200. Work shall not start until all materials, equipment, and labor are ready. The tapping tee and valve shall be installed in a horizontal position so that the valve stem is vertical. Where cut-ins are required in existing pipes, the work shall be conducted as to minimize the interruption of service. Necessary pipe, fittings and gate valves shall be assembled at the site ready for installation prior to the shut-off of water in the existing main. Once the water main has been shut off, the work shall be prosecuted vigorously and shall not be halted until the water main is back to service.

The interiors of all pipe and fittings, particularly couplings and sleeves, to be used in final cut-in connection shall be swabbed or sprayed with a 1% hypochlorite solution before they are installed.

Flushing shall start as soon as repairs or connections are completed and shall be continued until discolored water is eliminated. Flushing shall be done by the City Inspector.

### 4-3.31 SCHEDULE OF TESTS

The Contractor shall notify the City Inspector at least 2 business days before a section of water main is ready for inspection and test. The Inspector will inspect and observe the hydrostatic test. The Contractor shall contact the City at least 2 business days prior to purity test and flushing, the Contractor shall be present at the project site when the City Inspector takes water samples. The Contractor shall provide sufficient manpower and resources to accomplish the work in a timely manner. Flushing shall be done by or under direct supervision of the City Inspector.

### 4-3.32 HYDROSTATIC PRESSURE TESTS

Water main, appurtenances and service connections shall be tested in sections of convenient lengths under a hydrostatic pressure of 220 psi for 15 minutes.

Pumps, gauges, plugs, saddles, corporation stops, miscellaneous hose, piping, and measuring equipment necessary for performing the test shall be furnished and operated by the Contractor.

Sections to be tested shall normally be limited to a maximum of 1,000 feet. The pipe shall be backfilled sufficiently to prevent movement of the pipe under pressure. Thrust blocking shall be in place for an adequate time for concrete to cure before testing. Where permanent blocking is not required, the Contractor shall furnish and install temporary blocking and remove it after

testing.

The Contractor shall provide or rent from the City an approved DCVA to fill the new water mains for testing and flushing. The new water mains shall be filled and remain under 200 psi to 210 psi pressure for 24 to 48 hours to allow air to escape and the pipe lining of the pipe to absorb water.

The pressure test shall be accomplished by pumping the main up to 200 psi to 210 psi, stopping the pump for 15 minutes, and pumping the main up to the test pressure again. During the test, the section being tested shall be observed to detect any visible leakage.

A clean container shall be used for holding water for pumping up pressure on the main being tested. The quantity of water required to restore the pressure shall be accurately determined by pumping through a positive displacement water meter. The meter shall be approved by the City Inspector. Acceptability of the test will be determined as follows:

The quantity of water lost from the main shall not exceed the number of gallons per hour as determined by the formula:

$$L = \frac{SD\sqrt{P}}{266{,}400}$$

in which,

| | | |
|---|---|---|
| L | = | allowable leakage (gallons/hour) |
| D | = | nominal diameter of the pipe (inches) |
| P | = | test pressure during the leakage test (psi) |
| S | = | gross length of pipe tested (feet) |

There shall not be an appreciable or abrupt loss in pressure during the 15 minute test period. Any visible leakage detected shall be corrected by the Contractor regardless of the allowable leakage specified above. Should the tested section fail to meet the pressure test successfully as specified, the Contractor shall locate and repair the defects and then retest the pipeline. If the project is a City capital improvement project, there should be no additional cost to the City.

Tests shall be made with the hydrant auxiliary gate valves open and the hydrant valve in the closed position. Once the new line is successfully tested, each valve shall be tested by closing each in turn and relieving the pressure behind it. The mains shall be tested between valves. As possible, no hydrostatic pressure shall be placed against the opposite side of the valve being tested. This test of the valve will be acceptable if there is no immediate loss of pressure on the gauge when the pressure comes against the valve being checked. The Contractor shall verify that the pressure differential across the valve does not exceed the rated working pressure of the valve.

Prior to calling the City Inspector for pressure test, the Contractor shall have all equipment available for set up but not connected until the City Inspector is present for operation. All services shall be flushed.

Defective materials or workmanship discovered as a result of hydrostatic field test shall be replaced by the Contractor. Whenever it is necessary to replace defective material or correct the workmanship, the hydrostatic test shall be repeated to the satisfaction of the City.

## 4-3.33 DISINFECTION AND FLUSHING OF WATER MAINS

Before being placed into service, new water mains and repaired portions of existing mains shall be chlorinated and a satisfactory bacteriological report obtained. Disinfection of water mains shall be accomplished by the Contractor in accordance with the requirements of the *Washington State Department of Health*, AWWA Standard C651 and in a manner satisfactory to the City. Sections shall be disinfected between adjacent valves unless, in the opinion of the City Engineer, a longer section may be satisfactorily handled. All filling and flushing shall be done through a meter with a DCVA rented from the City. Valves shall be operated by City staff only.

### ***Flushing***

Where dry calcium hypochlorite is used for disinfection of the pipe, flushing shall be done after disinfection. If a hydrant is not installed at the end of the water main, the Contractor shall provide a tap large enough to develop a flow velocity of at least 2.5 feet per second in the water main. The flushing period must be approved by the City.

The source water used for disinfection and pressure testing shall be flushed prior to its use to ensure that contaminants or debris are not introduced into the new pipe.

Taps for temporary or permanent release of air, chlorination or flushing purposes shall be provided by the Contractor as a part of the construction of the water mains.

### ***Chlorination***

The section to be tested shall be chlorinated so that a chlorine residual of no less than 25 mg/l (parts per million or ppm) remains in the water after standing 24 hours in the pipe. The initial chlorine content of the water shall not be less than 50 mg/l. The forms of chlorine that may be used in the disinfection operations are liquid chlorine and calcium hypochlorite granules.

**Liquid Chlorine:** Chlorine shall be applied by solution fed at one end of the section with a valve or hydrant at the opposite end open sufficiently to permit a flow through during chlorine application. The chlorine solution shall be fed into the pipeline already mixed by an automatically proportioning applicator to provide a steady application rate no less than 50 mg/l (ppm) chlorine. Hydrants along the chlorinated section shall be open during application until the presence of chlorine has definitely been detected in each hydrant run. When a chlorine concentration of no less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours.

**Dry Calcium Hypochlorite:** Calcium hypochlorite conforming to AWWA B300 is available in granular tablet form and must contain approximately 65% available chlorine by weight. This procedure is allowed only when the extension has been kept clean and dry. If piping has been submerged, or is unclean, refer to AWWA Standard C651.

**Granulated chlorine:** (dry calcium hypochlorite at 65% - 70% chlorine) shall be placed in the pipe to yield a dosage no less than 50 mg/l. The number of ounces of 65% test calcium hypochlorite required for a 20 foot length of pipe equals 0.00843ld, in which "D" is the diameter in inches (WSDOT). The main shall be filled with water at a rate to ensure that the water within the main will flow at a velocity no greater than 1 foot per second. Precautions shall be taken to ensure that air pockets are eliminated. When a chlorine concentration of not less than 50 ppm has been established throughout the line, the valves shall be closed and the line left undisturbed for 24 hours. If the water temperature is less than 41 degrees F, the water shall remain in the pipe for at least 48 hours.

The line shall then be thoroughly flushed and water samples taken. The Contractor shall exercise special care in flushing to avoid damage to surrounding property and to conform to these Standards.

## 4-3.34 FINAL FLUSHING AND TESTING

Following chlorination, chlorinated water shall be flushed from the new water main until the replacement water throughout its length shows absence of chlorine. In the event chlorine is normally used in the source of supply, the tests shall show a residual not in excess of that normally carried in the water supply system (never to exceed 2 mg/l).

After final flushing and before the new water main is connected to the distribution system. The Contractor shall schedule the sample collection with the City a minimum of two (2) business days in advance of test. The number of samples from the source and the number of representative sample points required will be determined by the City Inspector. Appropriate sample taps shall be furnished by the Contractor. No hose or fire hydrant shall be used in the collection of samples.

At least one set of samples shall be collected from every 1,200 feet of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for total coliform bacteria and for heterotrophic bacteria by the heterotrophic plate count (HPC) analysis. The maximum allowable coliform content of the flushed sample shall be zero. The maximum allowable HPC population count in all source samples shall be 80/ml. Any source sample that exceeds a count of 80/ml shall be ruled as an indeterminate test and a new set of source and construction samples for analysis shall be required. The maximum allowable HPC population count from any construction sample shall be no greater than twenty (20) counts above the highest source HPC population count.

Before placing the lines into service, a satisfactory report shall be received by the City from the certified laboratory evidencing successful tests on samples collected from representative points in the system extension.

Should the initial test result in an unsatisfactory bacteriological test, additional chlorination using the above procedure shall be repeated until satisfactory results are obtained. The Contractor shall be responsible for disposal of treated water flushed from the mains.

Chlorinated water shall never be flushed into the storm drain or a body of water. This includes lakes, rivers, streams, and stormwater drainage systems, any waters where fish or other natural aquatic life can be expected.

## 4-3.35 ADJUST EXISTING STRUCTURE TO GRADE

### *Existing Structure Adjustment*

Existing structures, including valve box covers affected by a pavement overlay, or adjustment in surface grade, shall normally be adjusted to grade within three (3) business days after the pavement overlay. If the City determines that the structure is critical to operations immediate adjustment may be required.

### *Valve Box Adjustment in Paved Areas*

Raising the existing valve box shall be accomplished by adjusting the existing top section of the valve box or replacing the valve box.

If the valve box base section needs to be extended, the Contractor shall install a 4 inch diameter cast iron soil pipe, with the bell end of the soil pipe inserted over the top of the existing valve box base section. The spigot end of the soil pipe shall be located a minimum of 6 inches and a maximum of 9 inches below finished grade. The valve box top section shall be slipped over the soil pipe and adjusted to the final grade. A polyethylene sheet, 8-mil thick, shall be placed between the valve box and soil pipe to prevent metal to metal contact where the sections overlap.

In asphalt concrete pavement and overlay areas, excavation of the valve box to be raised shall be accomplished by saw cutting or neat line jack hammering the pavement a minimum of 12 inches around the perimeter of the valve box. The final adjustment of valve boxes shall be done within 24 hours after paving. Paving, repaving, and patching shall be completed within 72 hours.

### *Valve Box Adjustment in Unimproved Areas*

Adjustment of valve box covers located in unpaved areas shall be the same as in paved areas. Provide a minimum of 2 feet × 2 feet × 4 inch concrete pad at the surface as

indicated in City Standard Detail W-190.

## 4-3.36 ABANDONING FACILITIES

***Abandonment of Water Main***

Water mains no longer in service shall be removed and disposed of by the Contractor. The water main may be abandoned in place with the approval of the City Engineer.

When water mains are abandoned, the ends of the pipe and fittings shall be plugged with concrete which shall have a minimum length of 12 inches. The City may require the Contractor to fill the abandoned water mains with sand or cement grout depending on the size, material, and location of the water main.

***Abandonment of Services***

The Contractor shall remove the service lines, corporation stops and plug saddles with MIPT brass plug.

***Abandonment of Structures***

Abandonment of structures shall be completed only after water facilities have been properly abandoned. All valves and valve boxes shall be removed on abandoned valves.

## 4-3.37 LANDSCAPING AND LAWN REMOVAL AND REPLACEMENT

Any landscaping and lawn damaged by the Contractor shall be restored to conditions prior to construction. The Contractor shall try to minimize the area of disturbance and restore everything as close to the original condition as possible.

## 4-3.38 BORING UNDER ROOTS

Boring under the root systems of trees that cannot be removed shall be accomplished by excavating a trench or pit on each side of the tree, being careful to avoid root injury, and then hand digging or pushing the pipe through the soil under the tree. The pit walls shall be a minimum of 7 feet from the center of the tree and shall have sufficient depth to lay the pipe at the grade shown on the plan and profile. Trees shall be removed unless otherwise directed by the City Engineer.

## 4-3.39 BORING AND JACKING

The Contractor shall verify the vertical and horizontal location of existing utilities. If required to avoid conflicts and maintain minimum clearances, adjustment shall be made to the grade of the casing.

The pipe shall be bored and jacked where indicated. The Contractor shall remove or penetrate all obstructions encountered. If groundwater is found to be a problem during boring operations, the Contractor shall do all that is necessary to control the flow sufficiently to protect the excavation, pipe and equipment so that the work is not impaired. Any pipe damaged during the boring and jacking operation shall be repaired by the Contractor in a manner approved by the City Engineer.

Special care shall be taken during the installation of the bored and jacked pipe to ensure that no settlement or caving is caused to the above surface. Any such caving caused by the placement of the pipe shall be the Contractor's responsibility and the Contractor shall repair any area affected as directed by the City Engineer.

During the jacking operations, particular care shall be exercised to prevent caving ahead of the pipe which will cause voids outside of the pipe. If voids exist, the Contractor shall drill through the wall of the pipe and fill the voids by pumping cement grout. All voids shall be filled to the satisfaction of the City Inspector.

The carrier pipe shall be installed in the casing as shown in the City Standard Details. The Contractor shall support the carrier pipe with casing spacers as shown in the Standard Details. The casing spacers shall conform to these Standards. The material shall be resistant to abrasion and sliding wear. There shall be a minimum of two spacers per length of pipe, and the spacing between spacers shall be as shown in City Standard Detail W-230. Spacers shall be installed per manufacturer’s instructions.

Boring and receiving pits shall be backfilled with select native material approved by the City Engineer and compacted to 95% maximum dry density as determined by ASTM D-1557. The Contractor shall provide sufficient select backfill material to make up for the rejected material.

All disturbed ground shall be restored to its original condition or better.

## 4-3.40 WORKING WITH ASBESTOS CEMENT PIPE

When working with asbestos cement pipe, the Contractor is required to minimize workers’ exposure to asbestos material at or below the exposure limit as prescribed in WAC 296-62-07705 State and Federal Guidelines and Certification and PSAPCA requirements.

## 4-3.41 ASBESTOS CEMENT WATER MAIN CROSSINGS

Where a new utility line crosses below an existing asbestos cement (A.C.) water main, the A.C. water main shall be replaced with ductile iron pipe to a minimum of 8 feet on either side of the pipe crossing. Where directed by the City Engineer, the trench shall be backfilled with CDF from the bottom of the trench to the bottom of the A.C. main. All DIP crossings shall be constructed using ROMAC extended range transition couplings.

## 4-3.42 CONTROLLED DENSITY FILL

Controlled Density Fill (CDF) can be proportioned to be flowable, non-segregating, or excavatable by hand or machine. Desired flow-ability shall be achieved with the following guidelines:

| | |
|---|---|
| Low Flowability | below 6 inch slump |
| Normal Flowability | 6 – 8 inch slump |
| High Flowability | 8 inch slump or greater |

CDF shall be placed by any reasonable means into the area to be filled. CDF patching, mixing and placing may be started if weather conditions are favorable, when the temperature is at 34 degrees F and rising. At the time of placement, CDF must have a temperature of at least 40 degrees F. Mixing and placing shall stop when the temperature is 38 degrees F or less and falling. Each filling stage shall be as continuous as possible. CDF shall not be placed on frozen ground.

Trench section to be filled with CDF shall be contained at either end of the trench section by bulkhead or earth fill.

When used to support existing A.C. pipe, the flowable CDF shall be brought up uniformly to the bottom of the A.C. pipe, as shown on the plans, or as directed by the City Engineer. The Contractor shall provide steel plates to span the utility trenches and prevent traffic contact with CDF for at least 24 hours after placement or until CDF is compacted or hardened to prevent rutting by construction equipment or traffic.

If CDF is used for trench backfill on ductile iron pipe shall be encased in ⅝ inch minus crushed rock and services shall be encased in sand.

## 4-3.43 VAULT INSTALLATION

Vaults for water facilities (pressure reducing stations, valves, water service, flow meters, backflow prevention devices, etc.) shall be installed at the locations shown on the plan and as staked. It shall be constructed as shown on the plans, Standard Details and as directed by the City Engineer.

The excavation shall have a minimum of one (1) foot clearance between the vault outer surface and the earth bank. The Contractor shall use foundation gravel or bedding concrete on top of undisturbed soil to support the vault. The vault shall be plumb and watertight. The access cover shall be seated properly to prevent rocking and shall be adjusted to match the finished grade.

The vault floor shall drain to daylight, or to a location specified on the plans. Gravity drain pipe shall be a minimum of 3 inches in diameter.

Where knockout locations for the pipe do not coincide with the locations of pipe penetrations into the vault, the Contractor shall core drill openings for pipe.

A sump pump shall be required if directed by the City Engineer.

## 4-3.44 UTILITY CROSSING

If the minimum vertical distance between utility pipes is less than 6 inches and such installations are approved by the permitting agency, a rigid foam pad shall be placed between the pipes. The pad shall be; outside diameter (O.D) × O.D. × 2.5 inches thick minimum or as required to protect the pipes and O.D. is equal to the outside diameter of the larger pipe. The pad shall be a polyethylene foam plank (Dow Plastics Ethafoam 220), or approved equal. Additional measures may be necessary to ensure system integrity and may be required as evaluated by the permitting agency on a case by case basis.