

City of West Linn
Public Works Standard Construction Specifications

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DIVISION FOUR – WATER TECHNICAL REQUIREMENTS

401 GENERAL

The following specifications, in conjunction with applicable requirements of other parts of the contract documents, the plans, and addenda, shall govern the character and quality of material, equipment and construction procedures for water work. All work done shall be in compliance with the requirements and restraints of OSHA, the State of Oregon Accident Prevention Division regulations and the Workers' Compensation Board. In addition, all work shall be completed in conformance with State of Oregon, Clackamas County, and/or City of West Linn Public Works Permits.

402 WATER WORKS MATERIALS

402.01 DUCTILE IRON FITTINGS

- A. All fittings shall conform to ANSI/AWWA Specification C110/A21.10 or ANSI/AWWA Specification C153/A21.53. All ductile iron fittings shall be Class 350. Fittings shall be furnished with flanged or mechanical joints as specified on the plans. Fittings shall be furnished with a standard outside coating, and a cement mortar lining with bituminous seal coat conforming to ANSI/AWWA Specification C104/A21.4. Fittings shall be factory lined with cement mortar or cement lined to factory standards. No field coating with cement will be approved, other than for minor repairs and only with the express permission of the City Engineer.
- B. Fittings shall be new and free of defects in coating, body, and lining. During installation, fittings shall be properly aligned and bolted securely to provide watertight joints.
- C. Tees and crosses may be flanged or mechanical joint depending on the context
- D. Fittings shall be manufactured by Griffin, Trinity Valley, Tyler, Union Foundry, U.S. Pipe, or approved equal.

402.02 MECHANICAL JOINTS

- A. Mechanical joints, including accessory glands, gaskets, and bolts, shall conform to the requirements of ANSI/AWWA C111/A21.11, except where specifically modified in AWWA C153 for compact ductile iron fittings. As stated in AWWA C111, T-bolts shall be made of either high-strength cast iron containing a minimum of 0.50% copper, or high-strength, low alloy, steel. Bolts shall be marked to identify material and producer. Contractor shall provide the City Engineer with the bolt manufacturer's specifications, which shall give the following information: manufacturer's name, type of material, and identifying mark. Follower glands for mechanical joints shall be domestic made only.
- B. Mechanical joint gaskets shall be made of vulcanized synthetic rubber and shall be no more than three years old.
- C. The recommended installation procedures in AWWA SPECIFICATION C111, Appendix A, "Notes on Installation of Mechanical Joints", including bolt torque ranges, shall be followed.

402.02.01 Megalug® Retainer Glands

- A. Retainer glands packs on mechanical joints shall be Megalug® brand, as manufactured by Ebaa Iron Sales, Inc., ONLY. Megalug® shall be used on ductile iron pipe and fittings only. Exceptions must be specifically approved by the City Engineer, be submitted for review prior to beginning work, and conform to the specifications in this section. All parts, including bolts, retainer glands, and gaskets shall be new and free of defects.

- B. Restraint for standardized mechanical joints shall be incorporated in the design of the follower gland and shall impart multiple points of wedge action with gripper teeth against the pipe, increasing its resistance as the pressure increases. The assembled joint shall maintain its flexibility after burial and shall maintain its integrity by a controlled and limited expansion of each joint during the wedging action. Restraining glands shall be manufactured of high strength ductile iron conforming to the requirements of ASTM A 536, Grade 65-45-12 and shall meet the applicable requirements of ANSI/AWWA C110/A21.10. Wedges shall be contoured to properly fit on the pipe, and shall be manufactured of ductile iron, heat treated to a minimum hardness of 370 BHN.
- C. Dimensions of the glands shall be such that they can be used with the standardized mechanical joint bell and tee head bolts conforming to the requirements of ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of latest revision. Twist off nuts shall be incorporated in the design of the wedge actuating screws to ensure proper torque. The mechanical joint restraining device shall have a water working pressure rating of 350 psi for 3-16 in. and 250 psi for 18-48 in. with a safety factor of at least 2:1 against separation when tested in a dead-end situation, and shall be EBAA Iron, Inc. Megalug® or approved equal.

402.03 FLANGED JOINTS

- A. Flanges shall conform to ANSI Specification B16.1 for class 125 flanges and shall conform in all other respects to ANSI/AWWA C110/A21.11. Bolts for assembly of flanged joints shall be of the size and quantity shown in Table 10.14 on Page 34 of AWWA C110. As stated in AWWA C110, bolts shall conform to ANSI B18.2.1, Square and Hex Bolts and Screws Inch Series, Including Hex Cap Screws and Lag Screws. Nuts shall conform to ANSI B18.2.2, Square and Hex Nuts. Threads shall conform to ANSI B1.1, Standard for Unified Inch Screw Threads (UN and UNR Thread Form), Class 2A, external, and Class 2B, internal.
- B. Bolts and nuts shall be of low-carbon steel conforming to the requirements of ASTM A 307, Standard Specifications for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength, Grade B.
- C. Contractor shall provide the City Engineer with the manufacturer's specifications regarding the bolts to be used on the project.
- D. Flange gaskets shall be full face, 1/8 in. thick, red rubber or approved equal.

402.04 FLANGED PIPE OR SPOOLS

- A. Flanged pipe or spools shall conform to the latest edition of ANSI/AWWA C115/A21.15. Flanges shall conform to requirements as specified in **Subsection 402.04, FLANGED PIPE OR SPOOLS**. Pipe used shall be Class 53 D.I. Pipe shall be furnished with coatings as specified in "Ductile Iron Pipe". Threads on the flanges and pipe barrel shall be taper pipe threads (NPT) in accordance with ANSI B1.20.1.
- B. When ordering, the following minimum information shall be provided to the manufacturer: Pipe size and finished length (flg. to flg., flg. to p.e.).
- C. Manufacturer shall provide the following information: Length and weight shown on each pipe, flange manufacturer marking, country where cast, and D.I. or C.I. stamped on flanges. If fabricator is other than flange manufacturer, fabricator's mark shall be stamped with metal die on each flange after assembly. Also, manufacturer shall provide statement that the flange pipe complies with the specified standards.

402.05 DUCTILE IRON PIPE

All new water mains shall be Class 52 ductile iron. Physical properties shall not be less than 60-42-10 iron and pipe shall conform with the latest revision of ANSI/AWWA Specification C151/A21.51. Ductile Iron pipe shall be factory lined with cement mortar and bituminous seal coat and coated outside with asphaltic seal coat. Push-on rubber gasketed joints shall be provided unless mechanical, flanged, or locked joints are specified on the plans. Push-on and mechanical pipe joints shall conform with ANSI/AWWA Specification C111/A21.11 and flanged joints shall conform with ANSI/AWWA C115/A21.15.

402.06 POLYETHYLENE ENCASEMENT

- A. All water mains shall be wrapped with polyethylene encasement. The polyethylene encasement for use with ductile iron pipe shall meet all the requirements for ANSI/AWWA C105/A21.5, Polyethylene Encasement for Ductile Iron Pipe Systems. The preferred polyethylene encasement is "V-Bio Enhanced Polyethylene Encasements", or approved equal.
- B. Polyethylene encasement shall be installed according to the manufacturer's directions.

402.07 VALVES (GENERAL)

Direct-buried line valves of 12 in. size and larger shall be butterfly valves. All smaller, direct-buried line valves shall be gate valves. All valves shall be designed to AWWA specifications and shall have standard 2 in. square operating nut unless otherwise shown on the plans. All pipe valves and fittings shall be pressure rated at 250 to 350 psi and shall open counter clockwise. All fittings shall be factory cement lined and coated.

402.08 GATE VALVES

- A. Two-inch gate valves shall be resilient seat (RS), non-rising stem with "O" ring packing, complying with AWWA Class "C" Specifications. Gate valves 4 in. through 10 in. shall be resilient seat, non-rising stem with "O" ring packing, complying with AWWA Class C Specifications. The valves shall be designed to withstand water working pressures of 150 psi or more. All valves shall be furnished with a 2 in. square operating nut and shall open counter clockwise when viewing valve from above.
- B. Operation of the valve shall permit full withdrawal of the disc from the waterway to provide a clear unrestricted passage when the valve is in the open position. The valve shall be furnished with mechanical joint ends unless otherwise specified. Where flanges are furnished on valves, they shall conform with ANSI Specification B-16.1, Class 125.
- C. Specified 2 in. gate valves shall have a resilient wedge.

402.09 BUTTERFLY VALVES

All butterfly valves shall be rubber-seat type and bubble-tight at 150 psi pressure with flow in either direction. They shall be designed for direct burial and be satisfactory for application involving valve operation after long periods of inactivity. Valves shall conform to AWWA Specification C-504, Class 150B. All valves shall be Mueller or approved equal. Operating nut for the valve shall be located on the side of the main shown on the plans

402.10 FIRE HYDRANT ASSEMBLY

- A. Fire hydrants shall conform with AWWA Specification C-502 and Standard Drawing WL-RD254. The hydrants shall have a 5-1/4 in. minimum valve opening with a 6 in. mechanical joint inlet, a 6 in. mechanical joint by flanged resilient seat auxiliary gate valve, two 2-1/2 in. hose nozzles, a 4-1/2 in. pumper nozzle, a 1-1/2 in. pentagon operating nut (opening counter clockwise) and a safety flange. The hydrant color shall be Safety Yellow.
- B. The auxiliary valve shall be Mueller resilient seat No. A-2370-16 only and be furnished complete with cast iron valve box, complete with cover, galvanized bolts and gaskets.
- C. Fire hydrant shall be Mueller Super Centurion Model A-423 or Clow Medallion Model F-2545, or an approved equal.
- D. All hydrants shall be installed with a Storz Adapter.

402.11 CAST IRON VALVE BOXES

- A. Valve boxes shall be the cast iron "Vancouver" pattern (18 in. tall casting only). Valve riser pipe from the valve to the cast iron top shall be 6 in. PVC sewer pipe ASTM D 3034, SDR-35, or equal for the Vancouver box. See Standard Drawings.
- B. Valve box castings shall be smooth and uniform. Box lid shall not protrude above the rim and lids shall seat flat without rocking. Boxes of uneven thickness, pitted, or otherwise flawed in the casting will be rejected. PVC sewer pipe shall be cut off smooth with no sharp edges.

402.12 BLOW OFF UNITS

Blow off units shall consist of resilient wedge gate valves, copper pipe and standard valve boxes and covers as specified in **Subsection 403.08, PLACING PERMANENT BLOW OFF ASSEMBLIES** and on Standard Drawing WL-RD262.

402.13 AIR RELEASE VALVE UNITS

Air release valve unit shall consist of a double-strap 2 in. service saddle, 2 in. size with 1/4 bend adapt copper, Type K copper, 2 in. Val-matic No. 38 air release valve or approved equal, 2 in. Nibco No. 113 brass gate valve, 48 in. concrete manhole cone, taper-proof frame and cover, three 12 in. concrete pier blocks, one 12 in. x 12 in. x 4 in. concrete block, and brass ells, nipples and adapters as noted on the Standard Drawings.

402.14 2-INCH SERVICE SADDLES

Service saddles shall be 2 in. I.P.T., double strap, stainless steel. Body of saddle shall be Ductile Iron coated with nylon, and straps, bolts, washers, and nuts shall be stainless steel.

402.15 WATER SERVICE LINES

Service lines shall be consist of soft copper tubing or copper pipe, depending on the size. All 1" water services should be Type K soft copper tubing, All 2" water services should be Type K copper pipe. All copper water service lines shall meet ASTM B 88 specifications.

402.16 BRASS FITTINGS

402.16.01 Corporation Stops

One-inch corporation stops shall be Mueller B-25008, or approved equal. Two-inch corporation stops shall be Mueller H-15023, or approved equal.

402.16.02 Angle Meter Stops

One-inch angle meter stops shall be Mueller B-24258, or approved equal. Two-inch angle meter stops shall be Mueller model B-24276, or approved equal

402.16.03 Copper Unions

Three part copper to copper union shall be equivalent to Mueller 110 compression union.

402.16.04 Copper Couplings

Straight couplings, copper to inside iron pipe thread shall be Mueller 110 compression or equal. Copper couplings, copper to outside iron pipe threads, shall be Mueller 110 compression union or equal.

403 CONSTRUCTION

403.01 STORAGE OF EQUIPMENT AND MATERIALS

- A. Unless otherwise noted on the plans or in the special provisions, it shall be the responsibility of the contractor to locate an approved storage site for all equipment and materials.
- B. Prior approval shall be obtained from the governing agency for any storage of equipment or materials within the right of way (i.e., stringing of pipe).

403.02 PLACING AND BLOCKING PIPE AND FITTINGS

- A. The pipe shall be laid true to line, without objectionable breaks in grade and shall be firmly bedded for the entire length of the pipe.
- B. Where conflicts arise between the designed grade of the waterline and an existing underground structure, the depth of the trench may be increased to permit proper installation of the waterline. Payment for over excavation shall begin once the extra depth reaches 18 in. below the designed grade.
- C. Care shall be taken to clean joints and to keep them free of water during construction. Whenever water is excluded from the interior of the pipe, adequate backfill shall be deposited on the pipe to prevent floating. In the event of any flotation occurring, the pipe so affected shall be removed from the trench, replaced and re-laid at the Contractor's expense.
- D. Each section of the pipe and each fitting shall be thoroughly cleaned before it is lowered into the trench. Cleaning of each pipe or fitting shall be accomplished by swabbing out, brushing out, blowing out with compressed air, washing to remove all foreign matter. The most efficient method of cleaning out pipe and fittings will be determined on the job by the City Engineer.
- E. If clean pipe sections and fittings cannot be placed in the trench without getting dirt into the open ends, the City Engineer will require that a piece of tightly woven canvas be tied over the ends of the pipe or fitting or a mechanical plug be used until it has been lowered into position in the trench. After the pipe or fitting has been lowered into the trench, all foreign matter shall be completely brushed from the bell and spigot ends before assembly. At the end of each day, or during suspension of the work, the pipe ends shall be securely closed by means of a secure plug or approved equivalent. Water in the trench shall not be allowed to enter the pipe and fittings.
- F. All tees, elbows and any major changes in direction of pipe alignment shall be securely restrained using Megalug® MJ retainer glands and field lock gaskets to a distance as specified on the plans or as determined by the City Engineer.
- G. When thrust blocks are required or allowed by the City Engineer using appropriate size thrust block they shall be constructed based on the size and pressure of the water main to be constructed. All pipe and fittings in contact with concrete shall be completely wrapped in 2 layers of 8 mil plastic prior to the placement of the concrete as approved by the City Engineer. Concrete used for thrust blocking shall be commercially mixed, have a slump of 2 to 4 in. and a minimum 28-day strength of 3000 psi. Concrete mix shall be uniformly blended with appropriate quantity of water before being placed in the trench and shall not contain any dirt or other foreign matter. Thrust blocks shall be formed so that fitting joints remain accessible, and blocks that are to be removed in future waterline extensions shall be supplied with a rebar pulling loop and formed so that the block may be pulled off without disturbing the fitting. See Standard Drawing WL-408, WL-409, and WL-410. The cost of furnishing and installing blocking, rebar pull loops and plastic wrap shall be included in the unit prices bid.
- H. If it is necessary to cut the pipe to lay it on curves or to cause a change in direction, the Contractor shall cut the pipe as required for proper installation. Where the cut length of pipe is to be installed into the bell end of another pipe, the cut end shall be beveled to ensure a proper seal. To set valves and fittings properly, the pipe shall be cut to the exact length required to obtain the designated locations. The cost of cutting the pipe shall be included in the unit prices bid.

- I. Dead end lines, where a standard 2 or 4 in. blow-off assembly is not required by the plans, shall be provided with a 3/4 in. Corporation Stop 18 in. from the plugged end of the pipe. This will allow for air removal and release of line pressure during future waterline extension. No extra payment shall be made for this installation.

403.03 WET TAPPING EXISTING MAIN

- A. When specified, wet taps on existing water main are required to minimize interruption of service to customers. Typically, wet taps will only be performed under the direction and direct supervision of City personnel. Tapping sleeve and valve shall conform to Standard Drawing WL-410.
- B. Tapping machine shall be equipped with a coupon retaining pilot bit equipped with retaining clips capable of securely holding the core drilled coupon so that it does not fall back into the main. Contractors who lose the coupon or are unable to provide it for inspection may be fined and/or held liable for any and all costs, damages, and repair that occur as a result of the lost coupon, including, but not limited to, costs for City Water crews to recover the pipe coupon.
- C. Before attaching tapping sleeve, care shall be taken to clean water main of all debris and defects. Attach sleeve and valve to the main. Then attach proper tapping machine to valve. Pressure test this assembly before making tap. After making tap, remove the tapping machine and inspect fitting and valve for leaks. If any such leaks are found, contractor shall be required to repair the defect. Attach branch main to valve and install pipe. Tapping sleeve and valve shall be wrapped in 8 mil plastic and tape in accordance with Subsection 403.04, POLYETHYLENE ENCASEMENT OF PIPE AND FITTINGS. Taps shall be made no closer than 18 in. from end of sleeve to nearest joint.
- D. Excavation for tap shall be such as to fully expose main with a minimum depth below main of 12 in. A minimum of 18 in. of main shall be exposed from both ends of the tapping sleeve. Also, excavate enough area to accommodate tapping machine and workers. Backfilling shall be in accordance with **Section 204, EXCAVATION, EMBANKMENT, BEDDING, AND BACKFILL.**

403.04 POLYETHYLENE ENCASEMENT OF PIPE AND FITTINGS

- A. When specified, install polyethylene encasement, tube type, on all pipe and appurtenances. Polyethylene film shall conform to ASTM Standard Specification D 1248 78, having a minimum thickness of 0.008 in. (8 mil). Install this encasement in accordance with AWWA C105, Method A, one length of polyethylene tube for each length of pipe. The use of polyethylene sheets will not be allowed. Sand backfill shall be placed within the pipe zone and bedding area wherever polyethylene encasement is used.
- B. Cut tubing open if necessary to wrap valves and fittings. Valves shall be wrapped up to the bottom of the operating nut. Polyethylene shall be wrapped snugly around the pipe and held in place by using an adhesive tape compatible with polyethylene, plastic binder twine, or nylon tie straps. Backfill material shall not be allowed to get under the polyethylene, and pockets in the polyethylene which can trap backfill material shall be eliminated.

403.05 PLACING VALVE UNITS

- A. A valve unit shall consist of a valve, bolts, gaskets, followers, PVC riser pipe, and cast iron valve box, complete with cover.
- B. Valves shall be placed in a vertical position at locations shown on the plans. The Contractor shall check each valve to determine that the valve is properly adjusted to seat securely and open fully. Valves not meeting these requirements shall not be installed. Valve boxes and PVC riser pipe shall be placed in a vertical position over the valve operating nut and the backfill shall be carefully compacted around the box. Any valve boxes found off center from the valve operating nut shall be removed and replaced into the proper position. The top of the valve box shall be adjusted to meet finish grade.

- C. PVC riser pipe shall extend up inside the valve box 7 in. on the Vancouver box and 9 in. on the Portland valve box to allow future raising of the box. Notches shall be cut into the rim of the valve box on a line passing through the center of the box as detailed on the Standard Drawings. Valve boxes shall be placed so that the notches line up parallel with the water main below. A collar of concrete with a depth of 4 in. and a width of 6 in. shall be placed around the top of all valve boxes not in a paved area.
- D. The Contractor shall not operate any valve touching potable water.

403.06 PLACING FIRE HYDRANT ASSEMBLIES

- A. The fire hydrant assembly shall consist of a the hydrant, auxiliary gate valve, cast iron valve box, galvanized bolts, gaskets and tie rods.
- B. The fire hydrant shall be placed in a vertical position in an accessible location. Hydrant drain holes shall not be blocked. Clean drain rock shall be placed around the base of the hydrant for drainage up to 6-inches about the drain holes. Fire hydrant extension kits require Public Works Department approval.

403.07 COPPER SERVICE INSTALLATION

- A. Where indicated on the drawings or as determined in the field, the contractor will be required to install copper water services. This will require the contractor to make all taps for the service, install new copper pipe/tubing or transfer existing copper pipe/tubing to new main and install new corporation stops
- B. Where new 1 in. copper service tubing is to be installed at the existing meter locations, the new Angle Meter Stop shall be set at the same elevation as the existing Angle Meter Stop with a maximum of 2 in. away from connection point on the existing meter. All new copper pipe and service fittings shall be kept clean and free of debris. The City Water crew, or City contractor, will make connection of new Angle Meter Stop to existing meter. City water crews shall only have to remove the existing Angle Meter Stop, connect the new Angle Meter Stop, and flush the new service. Any extra time and materials required due to the Contractor's negligence shall be recorded and deducted from the Contractor's final payment.
- C. Where new services are installed, new meter boxes shall be set with the top of the box at finish grade. The longest dimension of the box shall be set perpendicular to the centerline of the street. A new meter box shall be provided where, in the opinion of the City Inspector, an existing meter box is cracked, broken, or has missing parts. Where an existing meter must be relocated, Contractor shall provide and install the new copper service, Angle Meter Stop, and meter box complete and adjusted, to finished grade. City Water crew will install the meter.
- D. All copper and brass structures shall be bedded and covered with 3/4 in. minus crushed aggregate to a depth of 6 in. on all sides. However, the interior of the meter box shall be backfilled with soft earth free of gravel and organic matter.
- E. Service lines shall be located in a direct line between the meter and a point on the main directly opposite the meter. Service lines shall have a minimum cover of 30 in. except where crossing road ditches where the cover may be reduced to 24 in. at said road ditch.
- F. Where existing copper service is to be transferred to new main, and the existing main is to remain live, City crew shall disconnect the corporation stop from the existing main and install a brass plug. Contractor shall provide excavation down to the existing corporation stop, select backfill and compaction. Excavation and backfill shall be considered incidental to the project. Contractor shall perform surface restoration according to the bid item for that work.
- G. All new services crossing existing metal gas lines shall have PVC sleeves as shown on the Standard Drawings.
- H. Corporation Stops shall be set at a 30° angle up from horizontal. Taps shall be a minimum of 18 in. from the bell or spigot end of the main or another service tap.

- I. Where a new section of copper service is to be installed, it shall be type K, seamless soft annealed copper pipe conforming with ASTM B 88. There shall be no splicing of copper unless service is longer than 60 ft. or as approved by the City Engineer (unique conditions). When splicing is approved between two pieces of copper, it shall be done with a three piece copper to copper union. No more than one splice per service shall be made and splicing shall be made outside of the existing or proposed travel lane. Existing galvanized service lines encountered by the contractor shall be replaced with copper service pipe up to and through the Angle Meter Stop.
- J. Where 2 in. services are installed, the new main shall be tapped 2 in. with a 2 in. corporation stop. Two inch rigid copper pipe and 2 in. Angle Meter Stop shall then be installed to the new meter location.
- K. Once the new copper services are installed by the Contractor and the new waterline facilities are pressure tested, chlorinated and accepted, City water crews shall relocate existing meters to their new locations and replumb the service. It shall be the responsibility of the Contractor to coordinate this with the City Construction Inspector. Placement of new sidewalks or other surface restoration shall not take place until meters have been installed.

403.08 PLACING PERMANENT BLOW OFF ASSEMBLIES

- A. A standard 2 in. blow off assembly shall consist of a plug tapped 2 in. I.P.T., 2 in. x 6 in. or 2 in. brass nipple, 2 in. RS gate valve, 2 in. x 2 in. galvanized tee with 2 in. plug, two valve boxes with covers, steel shim, thrust blocking, 2 in. Schedule 40 galvanized pipe, and a standard blow off drain.
- B. A 4 in. or 6 in. blow off assembly shall consist of a main size x 4 in. or 6 in. MJ x flange reducer, flange x flange RS gate valve, companion flange, galvanized 90° bend, schedule 40 galvanized piping, pier block, two valve boxes, galvanized coupling and galvanized bar plug.
- C. The blow off assembly shall be placed as shown in Standard Drawing WL-404A and WL-404B, securely blocked with concrete as required.
- D. The main line pipe shall be thrust restrained with a straddle block as shown on Standard Drawing WL-408 or concrete thrust block as shown on Standard Drawing WL-406. Blow-off pipe and fittings shall remain fully accessible for repair and replacement without disturbing thrust blocking.
- E. Payment for the blow off assembly shall include furnishing, transporting, assembling and placing of the complete assembly, blocking, plus backfill and servicing. Main line thrust blocking shall be paid under separate bid item.

403.09 PLACING AIR RELEASE VALVE UNITS

- A. An air release valve unit shall consist of a 2 in. double strap service saddle, 2 in. Corporation Stop with 1/4 bend copper adapter, 2 in. copper pipe, 2 in. brass gate valve, 2 in. air release valve, 48 in. concrete manhole cone with frame and cover and 12 in. concrete pier blocks, and other fittings for plumbing the unit and as noted on Standard Drawing WL-405.
- B. The air release valve unit shall be placed as shown on the plans, secure in place with concrete block and all crushed gravels compacted as specified.
- C. Placing the air release valve unit shall consist of transporting, assembling, and placing of the complete unit, tapping the water main, excavating and backfilling as specified and servicing.

403.10 REMOVING EXISTING WATER WORKS MATERIALS

- A. When the Contractor removes existing pipe, gate valve units, fittings, fire hydrant units or other items to allow installation of the work specified herein, he shall haul the removed water works materials to the Owner's designated storage yard unless otherwise directed by the City Engineer. Title to the removed materials shall remain with the Owner.

- B. The Owner reserves the right to designate other water works materials to be removed. The Contractor shall remove the designated water works materials and haul them to the Owner's designated storage yard.

403.11 ABANDONING EXISTING MAINS AND VALVES

Any existing water lines that are abandoned shall be severed and plugged as directed by the City Engineer. All abandoned valve boxes shall be cut off 12 in. below grade, gravel filled, and asphalt plugged at no additional cost.

403.12 MAINTAINING SERVICE

- A. The Contractor shall schedule construction work specified herein to maintain a continuous water service to existing water users. Where it is necessary to shut down service to make required interties, the Contractor shall notify the Owner at least five working days prior to a planned water service shut down to allow the Owner to notify users of the impending loss of water service.
- B. Notification to the City shall include both the Fire Department and the Public Works Department. Contractor may be required to make necessary service shutdowns of affected businesses after regular business hours at no additional cost to the Owner.

403.13 FLUSHING

- A. The New Pipeline shall be flushed, pressure tested, and disinfected before any connection to the existing water system is made. Temporary blow-offs shall be provided by contractor at all dead-ends and points of connection to the existing system. The new waterline shall be built as close as possible, as determined by the City Engineer, to the existing water system at points where connections are to be made.
- B. All pipe, valves and fittings shall be thoroughly flushed prior to pressure testing and chlorination. Flushing shall be done through blow off units, hydrants, individual services, and main at a minimum velocity of 2.5 F/S. All water used during flushing operations shall be measured through a Pitot Blade and stop watch. All results shall be reported to the City Engineer on a daily basis.
- C. Prior to any flushing procedures taking place, the Contractor shall issue a flushing plan providing direction of flow, water damage control and a written schedule to the City Engineer for approval. A 48-hour notice shall be given to the City Engineer prior to any system shut-down or flushing procedures. Under no circumstance shall the Contractor operate any City valves without prior approval by the City Engineer.
- D. The following chart shows minimum temporary blow-off/inlet sizes which shall be provided by the Contractor. Gate valves shall be provided on blow-off and inlet pipes to pressure test against, and to keep the pipe interior clean when backflow device is removed. See Standard Drawing 404A and 404B.

REQUIRED OPENINGS TO FLUSH PIPELINES

Nominal Pipe Size (inches)	Flow Required to Produce 2.5 FPS Velocity (gpm)	Minimum Inlet & Outlet Pipe Size Required (inches)
4	110	2
6	240	2
8	430	4
10	660	4
12	1950	4
14	1290	6
16	1690	6
18	2140	6
20	2640	6
24	3800	6

- E. All flushing and testing water shall be delivered to the new waterline through Oregon State Health Division approved double check valve backflow prevention devices.
- F. The Contractor shall provide or obtain a backflow prevention device. Certified backflow tester shall test device and furnish documentation to City Construction Inspector after device is installed on site.
- G. After flushing, the new system shall be pressure tested and disinfected. Payment for this item shall be included in the price bid for pipeline installation work.

403.14 TESTING AND CHLORINATION

- A. All of the pipe, fittings, services, and individual valves, except the last connection with the existing main, after being placed, must be pressure tested. If the contractor elects to test the line in sections, the lengths of the sections and provisions for testing shall be subject to approval by the City Engineer.
- B. Before testing the pipeline for leakage, the pipeline shall be thrust blocked. Thrust blocks shall be completed per Standard Drawing WL-406 and WL-407, must consist of commercially mixed concrete with a strength of not less than 3,000 psi at 28 days, and shall be allowed to cure for a minimum of five days prior to commencement of pressure testing (three days if high-early cement is used). The interior of the pipeline shall be thoroughly flushed per **Subsection 403.13, FLUSHING** to remove all foreign matter.
- C. Pressure testing shall commence only after backfill has passed the required compaction tests per AASHTO T-180 and the roadway base rock has been placed, compacted, proof rolled, and approved by the City Engineer.
- D. The water system must receive the City Engineer's approval regarding testing before paving of overlying roadways will be permitted. The contractor shall furnish necessary thrust blocks, pumps, medium range pressure gauges, means of measuring water loss, and all other equipment, materials and labor required for making the tests.
- E. All air vents shall be open during the filling of the pipeline with water. After a test section is completely filled, it shall be allowed to stand under slight pressure for at least 24 hours to allow the lining to absorb what water it will and to allow the escape of air from any small air pockets. During this period, the bulkheads, valves and exposed connections shall be examined for leaks. If any are found, they shall be stopped. The pressure shall then be raised slowly to the minimum hydrostatic pressure of 180 psi, or 1.5 times the normal working pressure, whichever is higher, measured at the point of highest elevation and shall be maintained for a period of at least one hour, beginning at a time of day to be mutually agreed upon between the Contractor and the City Engineer.

- F. Test pressure shall not exceed 150% of pipe pressure rating.
- G. No leakage is acceptable. While the pipe is under pressure and stabilized, an inspection for leaks along the pipeline shall be made by the Contractor. The test shall last for approximately one hour at a test pressure of 180 psi. The gauges should be graduate at 2 psi increments. Any leaks found shall be recorded and shall be repaired by the Contractor. All such repairs shall be made subject to the approval of the City Engineer.
- H. The Contractor, at his own expense, shall perform any excavation required to locate and repair leaks or other defects which may develop under the test. He shall remove backfill and paving already placed, shall replace such removed material, and shall make all repairs necessary to secure the required water-tightness. All repairs and re-tests shall be made at the Contractor's sole expense.
- I. All leakage tests shall be made in the presence of the City Engineer.
- J. The pipeline shall be thoroughly chlorinated, flushed, and tested in accordance with all state and local laws and the Oregon State Health Division's publication, "Public Water Systems", Oregon Administrative Rules (OAR) Chapter 333. All chlorinated water shall be discharged into the public sanitary sewer system. If a sanitary sewer is not available, the contractor shall employ the use of storage tanks, basins, or other means to transport or treat the chlorinated water for discharge to an approved point of disposal. Adequate quantities of chlorine in a water solution shall be added to the pipeline and shall be allowed to stand a sufficient length of time to sterilize the interior of the pipeline. The chlorinated water shall be flushed from the pipeline and a water sample shall be taken from the pipeline. The water sample shall be tested biologically and an acceptable certification that the water is safe for domestic water consumption shall be obtained before placing the pipeline into service. If the water is not safe, the Contractor shall chlorinate and flush the line and take new samples until an acceptable safe water certification is obtained.
- K. Chlorine may be applied by the following methods: Liquid chlorine gas/water mixture, direct chlorine gas feed, or calcium hypochlorite and water mixture. The chlorination agent shall be applied at the beginning of the section adjacent to the feeder connection and shall be injected through a corporation cock, hydrant, or other connection ensuring treatment of the entire line. Water shall be fed slowly into new line with chlorine applied in amounts to produce a dosage greater than 50 ppm but not more than 200 ppm throughout the system. After 24 hours, a residual of not less than 25 ppm shall be produced in all parts of the line. If the check measurement taken after the 24 hour period indicates a free chlorine residual of less than 25 ppm, the system shall be flushed, rechlorinated, and rechecked until a final residual of 25 ppm or more is achieved and at no additional expense to the Owner.
- L. During the chlorination process, all valves and accessories shall be operated. All parts of the line and services shall be chlorinated. After chlorination, the water shall be flushed from the line at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply. Care shall be taken to prevent discharge of chlorinated water directly to running streams. The water should be spread over the ground or held in ditches or seepage ponds. Water samples will be taken for bacteriological tests by the City of West Linn.
- M. The Contractor shall furnish and place all necessary fittings required for the testing, chlorinating and flushing of the pipeline. If a Corporation Stop is removed, the hole shall be filled with a brass plug.
- N. Water used in testing and flushing the pipeline shall be purchased from the City.

403.15 CUT-IN AND CONNECTION TO EXISTING MAINS

- A. After new waterline is flushed, pressure tested and disinfected, but prior to any cut-in and connects, contractor shall hold an on-site pre-connection meeting. Those to attend shall include on-site foreman, City inspector, City operations personnel, and City Engineer.
- B. This meeting shall take place prior to each connection and no longer than one week prior to the connection. At this meeting, contractor shall have all fittings, pipe, chlorine swabbing equipment, pumps and hoses, and all equipment needed to make the cut-in connect. Cut-in schedule and coordination shall be discussed.

- C. Once the bacteria test has been passed, cut-ins and connections to the existing water system shall be made by the contractor. All fittings necessary for the cut-in and pumps adequate to handle water in the trench shall be on hand and ready for service before connection is commenced. If the new waterline is opened to the air before contractor and City personnel are ready to proceed with the connection, or if new waterline is contaminated by dirt or dirty water, the new waterline shall be disinfected again.
- D. Fittings and pipe for cut-ins shall be swabbed out thoroughly with a 1% chlorine solution (1/2 lb. of 64% calcium hypochlorite in 4 gal. of water). Swabbing equipment and solution shall be kept clean and fresh.
- E. During each connection, work shall proceed without breaks until the connection is completed and water service is turned back on. Ground water shall not be allowed around any of the existing piping during the connection.
- F. After the connection is completed and water service is turned back on, a visual leak inspection of all fittings shall be done by the inspector prior to backfilling.
- G. All new lines under construction shall be physically disconnected from the existing City system. Under no circumstances shall a new line be connected to the existing water system prior to complete testing and acceptance by the City of West Linn.

403.16 CLAY DAMS

- A. Where indicated on the plans, or as directed by the City Engineer, the Contractor shall place clay dams to prevent ground water movement along the trench. Dams shall be made of impervious backfill material composed of particles at least 50% of which pass a No. 200 sieve, and with a plasticity index not less than 20, unless otherwise indicated on the plans.
- B. A dam shall fill the trench completely from side to side and top to bottom, except for the volume occupied by the pipeline and any materials required for surface restoration. Pipe in contact with clay dam will be wrapped with two layers of 8 mil polyethylene.
- C. Flow shall be considered in design of water and storm drain system.