

SECTION 02551

REUSE LINE CONSTRUCTION

PART 1 - GENERAL

1.1 Description

A. Description of the Work

The work to be performed in accordance with this section includes all work associated with reuse line construction including valves, tapping sleeves, fittings, ARV valves and other appurtenances.

The work shall include the furnishing of all labor, tools, equipment, materials and installation of tracer wire, as well as performing all operations required to provide a complete item in accordance with the project plans and these specifications. All materials incorporated into the work shall be new unless otherwise indicated on the project drawings and the Contract Documents.

B. Related Work Specified Elsewhere

Trench Excavation and Backfill Section 02300

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM A48, Specification for Gray-Iron Castings

ASTM A307, Specification for Carbon Steel Bolts and Studs

ASTM B88, Specification for Seamless Copper Water Tube

ASTM B766, Specification for Electro-Deposited Coatings of Cadmium

ASTM D2466, Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40

ASTM D1785, Polyvinyl Chloride (PVC) Plastic Pipe,
Schedules 40, 80, 120

ASTM D2467, Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80

AWWA C104, American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105, American National Standard for Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In., for Water and Other Liquids

AWWA C111, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings

AWWA C115, American National Standard for Flanged Ductile-Iron Pipe with Threaded Flanges

AWWA C151, American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

AWWA C203, Standard for Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C213, Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipeline

AWWA C303, Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pretensioned, for Water and Other Liquids

AWWA C500, Standard for Gate Valves, for Water and Sewerage Systems

AWWA C504, Standard for Rubber-Seated Butterfly Valves

AWWA C509, Standard for Resilient-Seated Gate Valves, for Water and Sewerage Systems

AWWA C550, Standard for Protective Epoxy Interior Coatings for Valves

AWWA C600, Standard for Installation of Ductile-Iron Water Mains and their Appurtenances

AWWA C800, Standard for Underground Serviced Line Valves and

Fittings

AWWA C901, Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inches for Water

Other miscellaneous AWWA and ASTM Standards

B. Hydrostatic Tests

All testing shall be in accordance with AWWA Standards. Perform pressure and leakage tests on all pipe or any valved section of it or both as required. Furnish all necessary assistance, equipment, and material and make all taps in the pipe as required. Utilize a saddle and corporation stop on all taps. All tests shall be witnessed by the **ENGINEER**.

For short segments of mainline pipe repair or replacement, 100 feet in length or less, where it is imperative that water service be restored immediately, the **ENGINEER** will waive pressure test requirements. When so approved, the joints, valves and fittings will remain exposed for pressurization to allow visual inspection for leaks. Upon satisfactorily passing visual inspection, backfill remaining trench in accordance with these specifications.

Furnish the following equipment and materials for the tests:

- 1 - 55 gallon drum.
- 1 - 5 gallon graduated container.
- 2 - Pressure gauges, liquid filled, 1% accuracy, 2-1/2 inch dial min. complete with surge and vibration dampeners.
- 1 - Hydraulic pump with air chamber. Suitable hose and suction pipe as required Suitable check valves and shut-off valves.

Conduct tests after the trench has been backfilled or partially backfilled with the joints left exposed for inspection. Where any section of pipe is provided with concrete reaction blocking, the pressure test shall not be made until at least five (5) days after the concrete reaction blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut to two (2) days instead of the five (5) previously specified.

Conduct the pressure test in the following manner: After the pipe has been backfilled or partially backfilled as specified, fill the pipe with water.

1. Test Pressure

Test pressure is in accordance with AWWA C600 and shall be one hundred eighty-eight (188) psig unless otherwise indicated on the plans or in the Contract Documents. Measured at the lowest elevation on the test section.

2. Duration

A minimum of two (2) hours.

3. Expelling Air

Before applying the specified test pressure, expel all air from the pipe.

4. Procedure

Slowly fill each valved section of pipe with water to fill the pipe and expel all air. Connect the test pump to the pipe in a satisfactory manner and operate the pump until the specified test pressure is achieved.

Valve off the pump and hold the pressure in the line for the test period. The pressure shall not vary more than five (5) percent from the specified test pressure during the test period. In the event that the pressure falls below the test pressure, the pump shall be operated to raise the pressure back to the specified test pressure. At the end of the specified time period, operate the pump to raise the pressure back to the specified test pressure. Measure all water necessary to restore the test pressure during and after the testing time period and include as leakage. The pump suction shall be placed in a graduated container so that the amount of water required to restore the test pressure can be measured accurately. Test equipment, which drips or leaks is not acceptable for pressure testing and will be rejected.

Mainline Hydrostatic Test

Make-up is defined as the total quantity of water necessary to maintain and restore the specified test pressure during and at the end of the test period. Water lines will not be accepted for payment until the makeup water is less than the number of gallons per hour as determined by the following formula:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

in which:

L = Allowable makeup water in gallons per hour

D = Nominal diameter of pipe in inches

P = Average test pressuring during the mainline hydrostatic test in pounds per square inch

S = Length of pipe tested in feet

Water lines which do not comply with the specified makeup water requirements will be rejected, and the **CONTRACTOR** shall, at his own expense, locate and repair the defective joints or pipe sections until the makeup water is within the specified allowance. ALL VISIBLE LEAKS SHALL BE REPAIRED REGARDLESS OF INITIAL TEST RESULTS AND SHALL BE RETESTED AFTER REPAIRS ARE MADE.

1.3 Submittals

A. Certificate of Compliance and Descriptions

1. Pipe
2. Valves
3. Fittings
4. Valve Boxes
5. Miscellaneous appurtenances

1.4 Product Delivery, Storage and Handling

Take all necessary precautions whether unloading, storing, and placing all equipment and components so as not to damage the product. All products with visible damage are subject to rejection.

PART 2 - MATERIALS

2.0 General

All materials utilized in the construction of reuse facilities, whether it is the replacement or relocation of existing facilities or the construction of new facilities, shall be new, previously unused, and in excellent condition. No existing materials shall be incorporated into the work, either by relocation or replacement of existing facilities, unless specifically stated on plans and indicated in the Contract Documents as directing the Contractor to reuse existing materials.

2.1 Pipe and Fittings

A. Ductile Iron Pipe

AWWA C151, with the thickness class indicated on the drawings or as recommended by the pipe manufacturer, but not less than the requirements of thickness Class 51 for push-on or mechanical joint pipe

1. Push-on and Mechanical Joints, AWWA C111.
2. Threaded Flanges, Ductile Iron, AWWA C115. DIP requiring threads for flanges shall not be less than that required by thickness Class 53.
3. Flange Bolts and Gaskets, AWWA C115, Appendix A.

B. Concrete Cylinder Pipe

Concrete cylinder pipe shall be manufactured and tested in accordance with AWWA C303. The average circumferential stress in the steel cylinder and bar or wire reinforcement of the pipe at design pressure shall not exceed 16,500 psi, nor 50 percent of the minimum yield strength of the steel used in the cylinder.

C. Ductile Iron Fittings

AWWA C110. Cement mortar lined and seal coated.

D. Polyvinyl Chloride (PVC)

Pipe shall conform to requirements of AWWA C900 (pressure-rated pipe, DR 25) for pressure pipe and fabricated fittings, 4 inch through 12-inch nominal pipe sizes. The pipe shall be made of PVC

plastic having a cell classification of 12454-B as defined in ASTM D1784.

E. Welded Steel Fusion Bond Epoxy Lined and Coated Pipe

Pipe shall conform to requirements of ASTM A381-96 for pressure pipe and fabricated fittings, for pipe 16 inches and larger. The pipe shall be made of Steel and will have fusion bond epoxy lining and coating per AWWA C213-01.

2.2 Couplings and Adapters

A. Flanged Coupling Adapter

Ductile iron or steel with flange template compatible with adjacent fitting or valve. Minimum working pressure rating not less than the adjacent valve, fitting or piping. Factory furnished with fusion bonded epoxy coating per AWWA C213. FCA shall be manufactured by Rockwell, Dresser or approved equal.

B. Flexible Couplings

One cylindrical steel middle ring, two steel follower rings, two resilient gaskets and high grade, high strength nuts and bolts. Factory furnished with fusion bonded epoxy coating per AWWA C213. Coupling shall be as manufactured by Rockwell, Dresser or approved equal.

2.3 Valves

A. Valves, 12 Inch and Larger

1. Butterfly Valve

AWWA C504, minimum 150 psig working pressure, NRS, 2 inch square operating nut, left hand opening, counter clockwise, EPDM seat, stainless steel valve shaft, ductile iron disk with stainless steel disk edge. Installed with valve shaft in horizontal position.

Factory applied minimum 6 mil dry film thickness epoxy coating on all interior and exterior ferrous surfaces. Epoxy coating per AWWA C550.

B. Gate Valves, 3 Inch to 10 Inch

AWWA C509, minimum 150 psig working pressure, resilient seated wedge, non-rising stem, O-ring packing, 2 inch square operator nut for buried service. Left hand opening, counter clockwise.

Factory applied minimum 6 mils dry film thickness, epoxy coating on all interior and exterior ferrous surfaces. Epoxy coating per AWWA C550.

C. Gate Valves, 2 Inches and Smaller

AWWA C800, minimum 150 psig working pressure. Threaded, all bronze, double disk, non-rising stem.

2.4 Valve Box and Riser

Valve boxes shall be Tyler Pipe/Union Foundry for 6850/60 series or an approved equal.

A. Operating Nut Less Than 3 Feet Below Surface

Valve boxes shall be two (2) piece or three (3) piece, depending on the manufacturer's recommendations. Valve boxes shall be the screw-type with a minimum 5-1/4 inch diameter shaft utilizing a standard drop lid. Valve boxes including upper part, lower part, extensions and lids shall be cast iron. The valve box shall be specifically designed for the type of valve for which it is used. The valve box shall be of proper length for the depth of cover. The word "REUSE", shall be cast into the top of the Lid.

B. Operating Nut Greater Than 3 Feet Below Surface

Riser pipe shall be minimum six (6) inch diameter Ductile Iron, Class 51 or an approved equal. Frame and cover, per ASTM A48, Class 30 painted or dipped with asphalt paint. Provide extension stem per detail. The word "REUSE" shall be cast into the top of the lid.

2.5 Combination Air Release Valves

Single body units built for 150 psi service. Design to vent large quantities or air during filling, opening to atmosphere during draining, and venting small amounts of air when pipeline is under pressure. Combination air release valve shall be the size and style indicated on Drawings, or approved equal.

2.6 Bolts and Nuts

A. Pipe Larger than 12-inches

ASTM A307, Grade B, carbon steel or ASTM A276, stainless steel.

B. Pipe 12 inches and smaller

ASTM A276, stainless steel or ASTM A307, Grade B, cadmium plated carbon steel per ASTM B766, minimum plating thickness of 0.0002 inches Class 2A threads, Class 2B threaded nuts or AWWA C111 cast iron tee head bolts with hexagon nuts.

2.7 Below Ground Corrosion Protection

A. Ferrous flanges, bolts, nuts, anchor bolts, rods, etc.

AWWA C203, hot coal tar epoxy minimum thickness 1/16 inch, with pan or cocoon method, complete coverage. The coal tar epoxy coating will not be required on stainless steel components.

B. Ferrous Pipe Polyethylene Protective Wrap

AWWA C105 plastic tube, 8 mils minimum, virgin polyethylene, purple. Secure with 2 inch wide pressure sensitive plastic tape, 10 mils minimum.

2.8 Concrete

Per Specification Section 3300, Concrete Structures, compressive strength as indicated on the plans but not less than 2500 psi.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify all preliminary work has been performed in accordance with these Specifications prior to performing water line construction.

3.2 Minimum Cover

Measure minimum cover from existing or proposed finish grade of pavement or natural ground, whichever is deeper. Place to depth as shown on the plan. If not shown, minimum cover from finish grade shall be as follows:

- A. Pipe less than 12 inches, minimum cover of 36 inches.**
- B. Pipe 12 inches or larger, minimum cover of 48 inches.**

3.3 Trench Excavation and Backfill

Per Specification Section 02300.

3.4 Installation

A. Ductile Iron Pipe

AWWA C600

B. General

1. Alignment and Grade

Lay pipes to the line and grade indicated on the plans. Place fittings and valves at the required locations. Plumb and level all equipment, fittings, valve stems, etc. Maximum deviation from alignment and grade shall not exceed 0.1 feet - horizontally or vertically. Where a deviation from the alignment or grade occurs, the pipeline will be gradually realigned to the proper location. Maintain positive or negative slopes as indicated on plans. Avoid making high spots in the pipeline. If a high spot cannot be avoided, an air release assembly must be installed at the high point.

2. Pipe Installation

Examine piping and appurtenances prior to placement. Replace defective materials. Prevent foreign materials from entering the pipe while it is being placed. No debris, tools, clothing or other materials shall be placed in the pipe at any time. As each joint of pipe is placed in the trench, assemble that joint and adjust the pipe to the proper line and grade. Install polyethylene encasement on ferrous pipe and fittings per ASTM C105 as pipeline placement proceeds.

3. Joint Assembly

Grind smooth and bevel cut ends and rough edges. Repair interior linings and coatings as required. Thoroughly clean bell and spigot ends, paying particular attention to the gasket and gasket recess. Use lubricant as recommended by the manufacturer, which meet the requirements of AWWA C111. Torque mechanical and flange joint bolts to specified torque. Do not exceed specified joint deflection.

C. PVC Pipe

AWWA C605-94

D. General

1. Alignment and Grade

Lay pipes to the line and grade indicated on the plans. Place fittings, valves, and hydrants at the required locations. Plumb and level all equipment, fittings, valve stems, etc. Maximum deviation from alignment and grade shall not exceed 0.1 feet - horizontally or vertically. Where a deviation from the alignment or grade occurs, the pipeline will be gradually realigned to the proper location. Maintain positive or negative slopes as indicated on plans. Avoid making high spots in the pipeline. If a high spot cannot be avoided, an air release assembly must be installed at the high point.

2. Pipe Installation

Examine piping and appurtenances prior to placement. Replace defective materials. Prevent foreign materials from entering the pipe while it is being placed. No debris, tools, clothing or other materials shall be placed in the pipe at any time. As each joint of pipe is placed in the trench, assemble that joint and adjust the pipe to the proper line and grade. Tracing Wire is required for all PVC or C900 force mains. For metal-detection equipment to assist in locating the line after installation, a tracer wire (Tapped/Attached to Pipe) or coated metal strip should be placed immediately above the initial backfill material and directly over the pipe. The tracer wire shall be insulated for protection from corrosion and be 12 or 14 gauge. Alternatively, plastic-coated metal strips that have been specifically designed for this purpose shall be used.

3. Joint Assembly

Inspect the bell and remove any foreign matter. Clean off the spigot end of the pipe and apply lubricant. Place the beveled end in the companion bell and provide straight alignment. Push the pipe straight into the bell with a block and bar until the stop mark on the spigot is even with the end of the bell.

E. Welded Steel Fusion Bond Epoxy Lined and Coated Pipe

AWWA C206-03

F. General

1. Alignment and Grade

Lay pipes to the line and grade indicated on the plans. Place fittings, valves, and hydrants at the required locations. Plumb and level all equipment, fittings, valve stems, etc. Maximum deviation from alignment and grade shall not exceed 0.1 feet - horizontally or vertically. Where a deviation from the alignment or grade occurs, the pipeline will be gradually realigned to the proper location. Maintain positive or negative slopes as indicated on plans. Avoid making high spots in the pipeline. If a high spot cannot be avoided, an air release assembly must be installed at the high point.

2. Pipe Installation

Examine piping and appurtenances prior to placement. Replace defective materials. Prevent foreign materials from entering the pipe while it is being placed. No debris, tools, clothing or other materials shall be placed in the pipe at any time. As each joint of pipe is placed in the trench, assemble that joint and adjust the pipe to the proper line and grade.

3.5 Polyethylene Pipe Wrap

AWWA C105, Method A. Place properly sized polywrap on each section of pipe prior to joining. Cut polyethylene tube 2 feet longer than length of pipe. Fold back excess over top of pipe and secure with tape at quarter points along the length of the pipe. Secure to previous section with 360 degree tape wrap. Polywrap shall be purple in color and conform to Arizona Code

R18-9-602.G.1

3.6 Valves and Valve Boxes

AWWA C600. Inspect valve and appurtenances. Check valve for direction of opening, freedom of operation, cleanliness and seating surfaces. Replace defective materials. Install valve on concrete slabs as detailed. Wrap valve and valve joints with polyethylene encasement per AWWA C105.

Place and plumb valve riser pipe as indicated, clean all rocks and debris from around operating nut. Set box frame to provide a minimum of 2 inches of travel between the box and the riser.

At the end of every day, valve boxes that are not clearly visible shall be marked with a stake indicating the location and depth in which to find the valve.

3.7 Connection to Existing Mains

Any connection to an existing main shall include a new valve. Expose existing pipe to be connected and verify location, size and type prior to constructing new mainline. The locations, sizes and depths of existing mains indicated on the plans are approximate only. Provide new reuse line as indicated on the plans prior to making connection to the existing reuse line. Coordinate connection to existing main with **OWNER** at least 48 hours in advance. The **OWNER** will operate existing valves but will not guarantee a complete shut down.

3.8 Mainline Pipe Replacement, 100 Feet in Length or Less

Gate valves shall be provided at the locations indicated on the plans prior to performing any work on the main line pipe. The maximum time allowed to install the gate valves shall be two hours unless separate arrangements have been made by the **CONTRACTOR** to supply water to the affected properties. After the gate valves have been accepted by the **ENGINEER**, City forces will close the valves and replacement of the main line pipe by the **CONTRACTOR** may proceed. Remove and replace piping per plans and these specifications. Place thrust blocking, temporary blocking, tie rods and backfill as required to hold the line in place for pressurization. Leave all joints, valves and fittings exposed for visual leakage inspection during pressurization. Upon approval of visual leakage inspection, complete placement and backfill per these specifications.

3.9 Anchor, Thrust Blocking and Joint Restraint

Place anchor, thrust blocking and joint restraint to MAG Specifications and Details 301, 302, 380, and 381 for all tees, plugs, caps, and bends and other locations where unbalanced forces exist. Place blocking against undisturbed ground surfaces. Do not place blocking or joint restraints until polyethylene wrap is secured in place. Place blocking neatly with straight sides and so joint bolts are accessible for future repairs.

3.10 Reuse line Crossings

A. Reuse Line Crossing Sewers

When constructing reuse lines near sewer pipe, construction shall be in accordance with Arizona Administrative Code R18-4-502 Minimum Design Criteria:

1. A reuse line shall not be placed:

- a.** Within six feet, horizontal distance, and less than two feet, vertical distance, above the top of a sewer main unless extra protection is provided. Extra Protection shall consist of constructing the sewer main with mechanical joint ductile iron pipe or with slip-joint ductile iron pipe if joint restraint is provided. Alternate extra protection shall consist of encasing both the water and sewer mains in at least six inches of concrete for at least ten feet beyond the area covered by this subsection.
- b.** Within two feet horizontally and two feet below the sewer main.

2. Minimum Separation

No reuse pipe shall pass through or come into contact with any part of the sewer manhole. The minimum horizontal separation between reuse mains and manholes shall be six feet measured from the center of the manhole.

B. Reuse Line Crossing Water Lines

When constructing reuse lines near water lines, or water lines near

reuse lines, construction shall be in accordance with Arizona Administrative Code R18-4-502 Minimum Design Criteria:

1. A water main shall not be placed:

- a. Within six feet, horizontal distance, or less than two feet vertical distance above the top of a reuse line unless extra protection is provided. For PVC pipe, Extra Protection shall consist of encasing both the water and reuse mains in at least six inches of concrete for at least ten feet in both directions of the crossing. When using mechanical joint ductile iron pipe or slip on joint ductile iron pipe, joint restraint is acceptable.
- b. Within two feet horizontally and two feet below the bottom of reuse main.

PART 4 - MEASUREMENT AND PAYMENT – Not Applicable

**** END OF SECTION 02551 ****