

## SECTION 8

### WATER LINES

#### 8.1 GENERAL

This section covers the requirements for piping materials and installation in the City of Cedar Hills' water distribution system. All materials and workmanship shall strictly comply with the current revisions of the Utah State Rules for Public Drinking Water Systems (USRPDWS) and the Uniform Plumbing Code (UPC). In the event of conflict between this section, USRPDWS and the UPC, they shall rank in the following order of precedence: 1) this Code Section; 2) USRPDWS; 3) UPC.

The end of water lines shall be covered when work is not in progress to prevent debris, animals, etc., from entering the line.

The cross connection between Pressurized Irrigation lines and Culinary Water lines is strictly prohibited.

All water lines shall be of eight (8) inch minimum size unless otherwise approved by the City Engineer.

If the size of any piping or fitting is not evident in the drawings, the Contractor shall request instructions from the City Engineer as to the proper sizing. Any changes resulting from the failure to contact the Engineer to request clarification shall be at the Contractor's expense.

#### 8.2 CONCRETE THRUST BLOCKING

All fittings at bends and branches in water pipe lines shall be provided with concrete thrust blocking as shown on the Standard Drawing no. 404. Blocking shall be constructed so the bearing surface is in direct line with the major force created by the pipe or fitting. Concrete shall be poured in place and shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as to not obstruct access to the joints of the pipe or fittings. The concrete mixture shall have a minimum 28-day compressive strength of 2500 pounds per square inch and shall comply with the requirements of Class C concrete as outlined in Section 5. All fittings shall be covered with plastic or other approved materials prior to pouring the thrust block. Thrust blocks shall be visually inspected prior to backfilling by the City Engineer or Public Works Department.

### 8.3 PIPE LAYING

Install pipe with bell ends facing the direction of laying. Where pipe is laid on a grade of 10 percent or greater, proceed uphill with the installation with the bell ends facing upgrade. Make gradual pipe elevation changes as practicable to clear existing obstructions.

The pipeline shall be installed so that a positive or negative grade is maintained between high and low points to avoid air pockets. Provide air vents as required. If permanent air vents are not required, record location of all high points so they may be readily located.

### 8.4 DUCTILE IRON PIPE

8.4.1 GENERAL Ductile iron pipe shall be Class 50 for slip-on or mechanical joint piping (Class 51 for eight (8) inch size and under) and Class 53 for flanged joint piping unless otherwise required by the City Engineer due to loadings, site conditions, etc.

8.4.2 MATERIALS Ductile iron pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C151 and ANSI A-21.51 "American Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids".

All pipes shall be made of good quality ductile cast iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the Standard. The metal for the ductile cast iron pipe shall be made by any suitable melting process.

8.4.3 JOINTS Ductile iron pipe shall be of the following types, as indicated on the approved plans.

A. Mechanical joints and the rubber gaskets and lubricant for ductile iron pipe, shall comply with the requirements and be dimensioned in accordance with AWWA C-151 and C-111. All gasket surfaces shall be smooth and free from imperfections. All mechanical joint gaskets shall be armor guard type gaskets and shall conform to tests in accordance with construction specifications and shall be less than one year old. Lubricant shall be non-toxic and have no deteriorating effects on gasket materials. Lubricants shall not impart taste, odor, or flavor to water in the pipe and shall comply with Utah State Department of Water Quality standards.

Bolts and rubber gaskets shall be furnished with mechanical joint pipe in sufficient quantity for the amount of pipe ordered.

B. Rubber gasket slip-on joints, and the rubber gaskets and lubricant for ductile iron pipe shall comply with the general requirements of AWWA C-111 of latest revision. Gaskets shall be free from defects and not over one year old. Lubricant shall be non-toxic and have no deteriorating effects on gasket materials. Lubricants shall not impart taste, odor, or flavor to water in the pipe.

Rubber gasket slip-on joints shall be designed for assembly by pre-positioning of a single continuous molded rubber ring gasket in an annular recess in the pipe socket, and forcing the plain end of the entering pipe into the receiving socket, thereby compressing the gasket radially to the pipe to form a positive seal. The plain end of the pipe shall be suitably beveled to facilitate assembly.

The design and shape of the gasket, and the annular recess therefore, shall be such that the gasket is locked in place against displacement as the joint is assembled. The gasket shall provide adequate compressive force between the plain pipe end and the socket after assembly to affect a positive seal under all combinations of joint and gasket tolerances.

The recess in the pipe socket for the rubber ring shall be free of all coating materials and sand pits. Rubber gaskets and lubricant shall be furnished with rubber gasket joint pipe in sufficient quantity to make each joint for the pipe ordered.

C. Cast iron pipe flanges, and bolts and nuts therefore, shall be dimensioned in accordance with ASA B16.2 for Class 150, and ANSI A 21.10. Threads for screwed on flange pipe shall comply with ASA B-2.1. Flange nuts and bolts shall be furnished with flange joint pipe in sufficient quantity to make each joint for the pipe ordered. Flange joints shall be bolted firmly with machine; stud or cap bolts of proper size. Flange shall be faced and drilled in accordance with ANSI A 21.10.

#### 8.4.4 FITTINGS

A. Mechanical Joint Fittings: Mechanical joint fittings shall conform to ANSI A 21.10, "American Standard for Cast Iron Fittings." Any manufactured angled face or bevel shall be removed from piping used in mechanical joints to ensure a full gasket seal.

B. Push-on Fittings: Push-on fittings shall conform to ANSI A 21.10 with bells, sockets, and plain ends per ANSI A 21.11.

C. Flanged Fittings: Flanged fittings shall conform to ANSI A 21.10, "American Standard for Cast Iron Fittings."

All flanges shall be faced and drilled. Where cap screws or stud bolts are needed, flanges shall be tapped to support cap screws or stud bolts. FM Grade grease shall be used for all bolted fittings.

8.4.5 LINING AND COATING. The waterway surfaces of all ductile iron water pipe and fittings shall be completely covered with a uniform thickness of cement-mortar or covered with a bituminous seal coat, all in accordance with AWWA C-104, and AWWA C-151. Ductile iron pipe or fittings lined in the field will not be accepted as conforming to AWWA C-104.

The outside surface of all "buried" ductile iron pipe shall be coated with a bituminous coating in accordance with AWWA C-151 requirements.

8.4.6 POLYETHYLENE ENCASEMENT The outside surface of all ductile iron pipe and fittings shall be encased with polyethylene film in tube or sheet form unless otherwise approved by the City Engineer.

The polyethylene film shall be manufactured of virgin polyethylene material conforming to the requirements of ASTM Standard Specification D-1248-68-- Polyethylene Plastics Molding and Extrusion Materials. The film shall have a minimum nominal thickness of 0.008" (8 mils) with a minus tolerance not exceeding 10 percent of the nominal thickness.

The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely air and watertight enclosure. Overlaps shall be secured by the use of polyethylene plastic tape, plastic string, or other materials capable of holding the polyethylene encasement in place under light tension until backfilling operations are completed.

Repair any rips, punctures, or other damage to the polyethylene with polyethylene plastic tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place.

Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

When valves, tees, crosses, and other odd-shaped pieces cannot be wrapped practically in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges together, folding over twice, and taping down. Tape the polyethylene securely in place at valve stem and other penetrations.

Provide openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene, with tape.

Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least two (2) feet. Secure the end with circumferential turns of tape.

All polyethylene-wrapped pipe, fittings, and valves shall be inspected for proper wrapping by the City Engineer or Public Works Department before backfilling operations.

**8.4.7 PIPE INSTALLATION** All pipe shall be laid as specified in AWWA Standard for "Installation of Water Mains" C-900, except as modified herein and in special conditions approved by the City Engineer.

Tees, elbows, crosses, and reducers shall be used for changes in direction and outlets, unless otherwise specified on the approved detail drawings.

Anchors, thrust bolts and thrust blocks shall be placed at valves, elbows, tees, etc., as shown on the approved detail drawings or as directed by the City Engineer.

All ductile iron pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a non-toxic joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint and gasket surfaces to facilitate easy, positive joint closure.

All pipes shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells and fittings.

Select bedding material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejoined as for new pipe installation. In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to the flow line. All joint offsets shall be made as specified in AWWA Standard for "Installation of Water Mains" C-900, except as modified herein and in special conditions approved by the City Engineer. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint

immediately after jointing has set, and pipe shall not be laid when conditions of the trench or weather is unsuitable for such work. At all times when work is in progress, all open ends of the pipe and fittings shall be securely closed to the satisfaction of the City Engineer, so that no water, earth, or other substance will enter the pipe or fittings.

8.4.8 GRAVEL FOUNDATION FOR PIPE USED Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe, the superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock, gravel or other suitable material as approved by the City Engineer, all such material shall be compacted into place.

Gravel for ductile iron pipe foundations shall be clean gravel with 100% passing a 1 1/2-inch screen and 5% passing a 3/4-inch sieve.

8.4.9 PIPE BEDDING All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded. A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled, with approved bedding material, and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes and pipe fitting holes shall be excavated so that only the barrel of the pipe and bottom quadrant of the fitting receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed six (6) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed into the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped or pushed into the trench in compact masses. Bedding materials shall be loose earth, free from lumps, boulders or other debris; sand materials free from roots, sod, or other vegetable matter. All bedding materials shall be approved by the City Engineer. Pea gravel shall not be accepted as a bedding or backfill material

In the event trench materials are not satisfactory for pipe bedding, modified bedding materials will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding materials shall be graded as follows: 100% passing a one-inch screen and 5% passing a No. 4 sieve. All modified bedding materials shall be approved by the City Engineer.

8.4.10 CLEANING AND FLUSHING The Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the Contractor. All temporary connections for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor.

All open ends of pipes shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

8.5 POLYVINYL CHLORIDE PIPE (PVC)

8.5.1 GENERAL This specification provides the requirements for Polyvinyl Chloride (PVC) Pressure Pipe with rubber gasket couplings and fittings for water supply and distribution systems. The pipe shall be blue in color for the culinary system and purple in color for the pressurized irrigation. Culinary and Pressurized irrigation main lines shall have a minimum horizontal separation of five (5) feet.

8.5.2 CONFORMANCE PVC pipe shall meet the following requirements:

CULINARY PRESSURE PIPE AND FITTINGS

Service	Buried
Conformance	Materials ASTM D1784 Latest Edition Manufacturing ASTM D2241, ASTM 1785
Fittings	
3" and larger	Ductile or cast iron mechanical or push on joint with transition gasket, AWWA C-110.
2" and smaller	Solvent cement ASTM D2564, Schedule 40 PVC
Wall Thickness	
8", 10", and 12"	C 900 (DR-18) (Class 200)
4" to 6"	C 900 (DR-18) (Class 200)
2" & 3"	Schedule 40

All PVC culinary pipes shall also conform to the latest revisions of the National Sanitation Foundation Testing Laboratories (NSF) specifications.

8.5.3 JOINTS The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of ASTM D-1869. The bell shall be designed to be at least as strong as the pipe wall.

8.5.4 MARKINGS Pipe markings shall include the following, marked continuously down the length:

- Manufacturer's name,
- Nominal Size,
- Class Pressure Rating,
- PVC Standard,
- NSF Logo (NSF-pw) for Culinary pipe, and
- Identification code.

8.5.5 PIPE INSTALLATION All PVC plastic pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a non-toxic joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surfaces to facilitate easy, positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Bedding material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejointed as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

Service lines and laterals must be assembled so that no strain is placed on the pipe during or after backfill operations. After laying of the pipe is completed, it shall be center loaded with backfill and bedding to prevent arching and whipping under pressure. Center loading should be done carefully so that joints will be completely exposed for examination.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

8.5.6 GRAVEL FOUNDATION FOR PIPE USED Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with 100% passing a 3/4-inch screen and less than 5% passing a #40 sieve.

8.5.7 PIPE BEDDING All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed six (6) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compacted masses. Bedding materials shall be loose earth, free from lumps, sand or gravel, free from rocks larger than one-inch diameter; with all materials free from roots, sod, or other organic matter.

8.5.8 MODIFIED PIPE BEDDING In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding material shall be graded as follows: 100% passing a one-inch screen and 5% passing a No. 4 sieve, or clean sand may be used to bed and cover PVC water lines.

8.5.9 CLEANING AND FLUSHING The Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the Contractor unless prior arrangements with the Cedar Hills City Public Works Department have been made. All temporary conditions for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor.

All open ends of pipe shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

8.5.10 LUBRICATION Lubrication shall be water soluble, non-toxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacteria growth, and have no deteriorating effect on the PVC or rubber gasket.

8.5.11 WARNING / LOCATING TAPE AND WIRE A brightly colored warning tape shall be placed in all trenches where PVC pipe is used. The tape shall be placed a minimum of 1 foot above the top of the pipe. Tape for culinary pipe shall be blue with the word culinary along the tape. A #10 gauge insulated copper tracing wire shall also be laid directly below each main water line and service lateral and connected to all valves or valve boxes for locating purposes as shown in Standard Drawing No. 406 & 502.

## 8.6 VALVES

Valves shall be of cast iron body, bronze-mounted, parallel seat, non-rising stem design with o-ring seals. Valves shall be AFC, Mueller or equivalent. Valves shall be attached to flanged tees or crosses at intersections. The maximum gate valve size shall be 10 inches. All valves 12 inches or larger shall be butterfly valves.

8.6.1 GATE VALVES Gate valves shall conform to AWWA Specification C500. Unless otherwise shown or specified, valves shall be of mechanical joint connection design for buried service. Buried valves shall have two-inch operating nuts. All gate valves ten (10) inch and smaller shall be of resilient seat type. Valves shall have a minimum working pressure of 200 psi.

8.6.2 BUTTERFLY VALVES Butterfly valves shall conform to AWWA Specification C504 Class 250. Both valved ends shall be mechanical joint per AWWA Specification C111, and accessories (bolts, glands, and gaskets) shall be included.

8.6.3 VALVE BOXES All buried valves shall be installed complete with a cast iron, two-piece, slip top, 5-1/4 inch shaft valve box. Round lids shall be used and the word "Water" shall be cast on the cover for all culinary valves. For pressurized irrigation, triangular lids shall be used and the word "P.I." shall be cast on the cover. All valve boxes located in streets shall be installed as closely to street grade as possible.

8.6.4 BACKFILL All valve clusters shall be backfilled with gravel to the bottom of the road base and consolidated in 2' maximum lifts.

## 8.7 FIRE HYDRANTS

8.7.1 GENERAL Fire Hydrants shall conform to AWWA C-502, "Fire Hydrants for Ordinary Water Works Service" and shall be designed for a working pressure of 150 psi. Hydrants shall be Waterous type or approved equal.

8.7.2 HYDRANT DETAILS The hydrant shall be of the dry barrel design. All hydrants shall be so designed as to allow the flanges at sidewalk level to separate without

material damage to the main barrel section when struck by a large object, such as a car. All hydrants shall have a minimum five (5) inch barrel and be furnished with two 2-1/2 inch National Standard Thread Hose Nozzles and one 4-1/2 inch National Standard Thread Pumper Nozzle. All nozzles shall be furnished with a cap and gasket with attaching chain.

Bury length shall be 4-1/2 foot.

Hydrants shall be painted red and cleaned of construction debris, dirt and concrete.

The seat must be made of molded non-swelling rubber.

The drip valve shall be located near the bottom of the hydrant. It shall be positive in operation and shall work directly from the main stem. It must be so designed that all water will drain away from the working parts when the hydrant is closed.

Hydrant cover must be designed so as to be weather proof as possible. Provisions must be made for oiling, both for lubrication and to prevent corrosion. A reasonably tight fit should be made around the stem. On the cover an arrow and the word "OPEN" shall be placed in raised characters to indicate direction to turn to open the hydrant.

The hydrant must be marked with the name or particular mark of the manufacturer. The size of the hydrant shall also be cast in the barrel. All lettering is to be above the ground or sidewalk flange.

8.7.3 AUXILIARY VALVE All hydrants shall be supplied complete with a flange by mechanical joint end auxiliary gate valve with armor guard gasket, and shall be installed at the water main as outlined, in Standard Drawing No. 401 & 402, on approved construction drawings unless otherwise approved by the City Engineer. All buried auxiliary valves shall have two-inch operating nuts unless otherwise specified.

8.7.4 VALVE BOXES All buried auxiliary valves shall be installed complete with two-piece, cast iron, slip type, 5 1/4-inch valve box. All valve boxes shall be carefully inspected for proper fit between each section, ring and lid, and shall be set to the grade with a concrete collar as shown.

8.7.5 HYDRANT INSTALLATION All fire hydrants shall be installed with a 1 cubic yard gravel sump and concrete thrust blocking. See City specifications for thrust blocking. Concrete shall not be placed around joints, bolts or drain holes. Cover all metal contact areas with a poly wrap material prior to concrete placement. All hydrants shall be installed with the upper safety flange at least two (2) inches and not more than six (6) inches above ground level. All hydrants shall be installed with the steamer nozzle facing the street unless otherwise approved by the City Engineer. Curb and gutter within 15 feet on either side of hydrant shall be painted red by contractor.

8.7.6 HYDRANT SPACING In general, fire hydrants shall not be spaced further than 500 feet apart along the street. Spacing may be as close as 300 feet in high density areas as determined by the City. No dwelling shall be further than 250 feet from a fire hydrant (measured along the curb and into the dwelling). Additional fire hydrants may be required at the discretion of the Fire Marshall and City Engineer due to specific building ordinances and/or City requirements.

## 8.8 SERVICE LATERALS

8.8.1 PIPING Pipe for water services shall be 200 psi poly-ethylene DR-18 water tubing or approved equal, with a one-inch inside diameter or larger. All fitting lubricant or sealants shall be food grade.

8.8.2 BEDDING All service laterals shall be bedded in sand or approved equal.

8.8.3 CORPORATION STOPS Connections to main lines shall be through a corporation type stop of AWWA thread type with flared copper connection of Mueller H-15000 type or approved equal.

8.8.4 METER BOX YOKE ASSEMBLY A typical meter box yoke assembly (for a single family dwelling) shall consist of a one-inch copper to iron pipe adapter "Mueller" or approved equal. All meter yoke assemblies shall be no more than 20 inches and not less than 16 inches below finish ground level unless otherwise specified by the City Engineer. Yoke assembly shall be bedded in clean ½" minus gravel.

8.8.5 METER BOXES AND LIDS Meter boxes shall be round, 20 inches inside diameter, smooth wall PVC, or an approved equal. The lids for meter boxes shall be cast iron with a lifter worm lock, operated by a large pentagon head bolt, radio read adaptable (2" hole). All meter box lids poured in concrete shall be a 21" can with a 19.5" lid, D & L supply model number B-5021 or equivalent shall be installed and inspected in accordance with the approved Standard Drawing No. 406 unless otherwise specified by the City Engineer. Meter boxes shall be not further than twenty-four (24) inches behind the sidewalk.

## 8.9 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall be installed on all culinary service connections in conformance with requirements of the Uniform Plumbing Code Chapter 10 (Appendix J). All testing, maintenance, and/or repair shall be performed by certified backflow assembly technicians.

8.10 CULINARY WATER LINE CONSTRUCTION NEAR SEWER OR WASTEWATER LINES (APPLICABLE PUBLIC HEALTH DEPARTMENT CRITERIA)

8.10.1 WATER/SEWER LINE HORIZONTAL SEPARATION A culinary water main and lateral must be laid at least ten feet horizontally from any existing or proposed sewer or wastewater leach line, main, or lateral. Separation distances shall be measured pipe edge to pipe edge. All culinary water lines shall comply with Department of Environmental Quality Safe Drinking Water rules and regulations.

Should local conditions prevent a horizontal separation of ten feet or less, a culinary water main and or lateral may be laid closer than ten feet to sewer lines (but not leach lines) provided:

- A. The main is laid in a separate trench, or
- B. The main is laid on an undisturbed earth shelf on one side of the sewer line trench, or
- C. The main is laid in a sewer or drain line trench which has been backfilled and compacted not less than 95% of maximum laboratory density. (The density shall be determined in accordance with the procedures given by ASTM Standard D-690).

In each of the above cases, the bottom of the culinary water line shall be at least 18 inches above the top of the sewer line. At the same time, the culinary water line must be sufficiently buried to prevent freezing.

8.10.2 EXCEPTION TO HORIZONTAL SEPARATION When it is impossible to obtain the proper horizontal and vertical separation as stipulated above, both the water main and sewer line shall be constructed of cast iron, ductile iron, or protected steel pipe having mechanical joints. Other types of joints of equal or greater integrity may be used at the discretion of the City Engineer. Thermoplastic pipe may be used provided mechanical or solvent weld pipe joints are used. These lines shall be pressure-tested to assure water tightness before backfilling.

8.10.3 CULINARY WATER/SEWER LINE CROSSINGS Whenever culinary water mains must cross sanitary sewers, the water main shall be laid at such an elevation that the bottom of the water main is 18 inches above the top of the sewer. This vertical separation should be maintained for the portion of the water main located within ten feet horizontally of any sewer it crosses. The ten feet is to be measured as the perpendicular distance from the sewer line to the water line.

8.10.4 INABILITY TO PROVIDE VERTICAL SEPARATION Where conditions prevent the minimum vertical separation as set forth above from being maintained, or

when it is necessary for the culinary water main to pass under a sewer, both the culinary water main and the sewer line shall be constructed of cast iron, ductile iron, or protected steel pipe, having mechanical joints. Thermoplastic pipe may be used provided mechanical or solvent weld type joints are used. The mechanical joint pipe shall extend on each side of the crossing until the perpendicular distance from the sewer line to the culinary water line is at least ten feet. In making such crossings, it is preferable to center a length of culinary water main so that the joints will be equidistant from the sewer and as remote therefrom as possible.

Where a culinary water main must cross under a sewer, a vertical separation of at least 18 inches between the bottom of the sewer and the top of the culinary water main shall be maintained with adequate support for the larger sized sewer lines to prevent them from settling on and breaking the culinary water main.

In the case where a new culinary water line must be routed under an existing sewer line, and it is desired not to disturb the sewer line, the City Engineer may grant an exception to the above requirements. The designer must then propose a method for protecting the culinary line. Such a proposal must be deemed acceptable in writing by the City Engineer.

## 8.11 TESTING WATER LINES

8.11.1 GENERAL Any and all water lines that are replaced, installed, or repaired, to include fire hydrants, shall be tested and flushed as outlined in this section.

8.11.2 TESTING Tests shall be made upon completion of system installation, replacement, repair, or any valved portion thereof. All tests shall be made at the expense of the Contractor and in the presence of the City Engineer or the City Water Superintendent. A notice of 48 hours must be given prior to testing. All testing shall meet or exceed the minimum requirements for Department of Environmental Quality Safe Drinking Water Rules.

Lines shall be slowly filled with water venting off all air. If required, taps shall be provided at line high points to bleed off the air and after testing these shall be plugged. A minimum pressure of 200 PSI shall be maintained on the portion being tested for a minimum period of two hours, using hydraulic means to maintain the pressure.

8.11.3 FLUSHING After pressure testing all pipelines shall be flushed. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the Contractor shall install a tap of sufficient size to provide for a 2.5 foot per second flushing velocity in the line. The following is the flow quantity required to provide a 2.5 foot per second flushing velocity:

Pipe Size	Flow
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<u>(in.)</u>	<u>(gpm)</u>
2	25
4	100
6	220
8	390
10	610
12	880
16	1567

## 8.12 DISINFECTION OF CULINARY WATER LINES

8.12.1 GENERAL All culinary water lines shall be disinfected by chlorination prior to use as outlined in this section.

8.12.2 CHLORINATION After flushing, all culinary water lines shall be disinfected by chlorination. Chlorination shall provide a minimum of 50 ppm residual after 24 hours contact in the pipeline. This may be expected with an application of 50 ppm although some conditions may require more. Chlorine, in the form of 1% slurry of high test calcium hypochlorite (HTH, Perchloron, Pittchlor, etc.) shall be fed into the pipeline in such a manner as to mix with the water flowing in the pipeline. A 1% slurry results from mixing one (1) pound of the calcium hypochlorite with 7.50 gallons of water.)

The following table provides information as to the required quantity of slurry to be used per 100 feet of pipe to provide a chlorine concentration of 50 ppm:

<u>Pipe Size (in.)</u>	<u>Vol. of 100 ft. Length (gal)</u>	<u>Req'd. Amount of Slurry (gal)</u>
4	65	0.33
6	147	0.74
8	261	1.3
10	408	2.0
12	588	3.0
16	1044	5.2

During the process of chlorinating the pipeline all valves, fire hydrants, and other pipeline appurtenances shall be operated several times to provide sufficient contact with the chlorinating agent. Following chlorination, by the contractor, the water line shall be drained and thoroughly flushed and, if necessary, re-chlorinated until a satisfactory bacteriological test is obtained. After 24 hours of chlorination, the water line shall be made available to draw bacteriological samples at the direction of the City Engineer or Public Works Department. A notice of 48 hours must be given prior to testing.

## PRESSURIZED IRRIGATION

### 8.13 GENERAL

This section covers the requirements for piping materials and installation in the City of Cedar Hills' pressurized irrigation system. All materials and workmanship shall strictly comply with the current revisions of the Uniform Plumbing Code (UPC). In the event of conflict between this section and the UPC, they shall rank in the following order of precedence: 1) this Code Section; 2) UPC.

The cross connection between Pressurized Irrigation lines and Culinary Water lines is strictly prohibited.

The end of the pressurized irrigation lines shall be covered when work is not in progress to prevent debris, animals, etc., from entering the line.

All pressurized irrigation lines shall be of eight (8) inch minimum size unless otherwise approved by the City Engineer.

If the size of any piping or fitting is not evident in the drawings, the Contractor shall request instructions from the City Engineer as to the proper sizing. Any changes resulting from the failure to contact the Engineer to request clarification shall be at the Contractor's expense.

### 8.14 CONCRETE THRUST BLOCKING

Concrete thrust blocks shall be required on all bends in the main pressurized irrigation line and in those places where the main line ends. Blocking shall be constructed so the bearing surface is in direct line with the major force created by the pipe or fitting. The thrust blocks shall be inspected before and after the concrete is poured and prior to backfilling by the City Engineer or Public Works Department. Concrete shall be poured in place and shall bear against solid undisturbed earth at the sides and bottom of the trench excavation and shall be shaped so as to not obstruct access to the joints of the pipe or fittings. The joints shall be wrapped with plastic before thrust blocks are poured. The concrete mixture shall have a minimum 28-day compressive strength of 2500 pounds per square inch and shall comply with the requirements of Class C concrete as outlined in Section 5.

### 8.15 PIPE LAYING

The pressurized irrigation lines shall be laid to grade so they can be drained and avoid air pockets. Provide air vents as required. If permanent air vents are not required, record location of all high points so they may be readily located. Where lines cannot be laid to drain properly, city approved drain lines shall be installed to insure proper drainage. Install pipe with bell ends facing the direction of laying. Where pipe is laid on a grade of 10 percent or greater, proceed

uphill with the installation with the bell ends facing upgrade. Make gradual pipe elevation changes as practicable to clear existing obstructions.

All pressurized irrigation mains shall be located on the south or west side of the culinary main lines as shown on Standard Drawing no. 202. Pressurized irrigation main lines constructed within the same trench as culinary main lines shall be constructed as shown on Standard Drawing no. 503.

All saddles shall be installed so that the corp stop valve is pointed upwards at a 45 degree angle toward the direction of the service lateral is to be laid. See Standard Drawing No. 407.

#### 8.16 DUCTILE IRON PIPE

8.16.1 GENERAL Ductile iron pipe shall be Class 50 for slip-on or mechanical joint piping (Class 51 for eight (8) inch size and under) and Class 53 for flanged joint piping unless otherwise required by the City Engineer due to loadings, site conditions, etc.

8.16.2 MATERIALS Ductile iron pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C151 and ANSI A-21.51 "American Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids".

All pipes shall be made of good quality ductile cast iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the Standard. The metal for the ductile cast iron pipe shall be made by any suitable melting process.

8.16.3 JOINTS Ductile iron pipe shall be of the following types, as indicated on the approved plans.

A. Mechanical joints and the rubber gaskets and lubricant for ductile iron pipe, shall comply with the requirements and be dimensioned in accordance with AWWA C-151 and C-111. All gasket surfaces shall be smooth and free from imperfections. All mechanical joint gaskets shall be armor guard type gaskets and shall conform to tests in accordance with construction specifications and shall be less than one year old. Lubricant shall be non-toxic and have no deteriorating effects on gasket materials. Lubricants shall not impart taste, odor, or flavor to water in the pipe and shall comply with Utah State Department of Water Quality standards.

Bolts and rubber gaskets shall be furnished with mechanical joint pipe in sufficient quantity for the amount of pipe ordered.

B. Rubber gasket slip-on joints, and the rubber gaskets and lubricant for ductile iron pipe shall comply with the general requirements of AWWA C-111 of

latest revision. Gaskets shall be free from defects and not over one year old. Lubricant shall be non-toxic and have no deteriorating effects on gasket materials. Lubricants shall not impart taste, odor, or flavor to water in the pipe.

Rubber gasket slip-on joints shall be designed for assembly by pre-positioning of a single continuous molded rubber ring gasket in an annular recess in the pipe socket, and forcing the plain end of the entering pipe into the receiving socket, thereby compressing the gasket radially to the pipe to form a positive seal. The plain end of the pipe shall be suitably beveled to facilitate assembly.

The design and shape of the gasket, and the annular recess therefore, shall be such that the gasket is locked in place against displacement as the joint is assembled. The gasket shall provide adequate compressive force between the plain pipe end and the socket after assembly to affect a positive seal under all combinations of joint and gasket tolerances.

The recess in the pipe socket for the rubber ring shall be free of all coating materials and sand pits. Rubber gaskets and lubricant shall be furnished with rubber gasket joint pipe in sufficient quantity to make each joint for the pipe ordered.

C. Cast iron pipe flanges, and bolts and nuts therefore, shall be dimensioned in accordance with ASA B16.2 for Class 150, and ANSI A 21.10. Threads for screwed on flange pipe shall comply with ASA B-2.1. Flange nuts and bolts shall be furnished with flange joint pipe in sufficient quantity to make each joint for the pipe ordered. Flange joints shall be bolted firmly with machine; stud or cap bolts of proper size. Flange shall be faced and drilled in accordance with ANSI A 21.10.

#### 8.16.4 FITTINGS

A. Mechanical Joint Fittings: Mechanical joint fittings shall conform to ANSI A 21.10, "American Standard for Cast Iron Fittings." Any manufactured angled face or bevel shall be removed from piping used in mechanical joints to ensure a full gasket seal.

B. Push-on Fittings: Push-on fittings shall conform to ANSI A 21.10 with bells, sockets, and plain ends per ANSI A 21.11.

C. Flanged Fittings: Flanged fittings shall conform to ANSI A 21.10, "American Standard for Cast Iron Fittings."

All flanges shall be faced and drilled. Where cap screws or stud bolts are needed, flanges shall be tapped to support cap screws or stud bolts. FM Grade grease shall be used for all bolted fittings.

8.16.5 LINING AND COATING. The waterway surfaces of all ductile iron pressurized irrigation pipe and fittings shall be completely covered with a uniform thickness of cement-mortar or covered with a bituminous seal coat, all in accordance with AWWA C-104, and AWWA C-151. Ductile iron pipe or fittings lined in the field will not be accepted as conforming to AWWA C-104.

The outside surface of all "buried" ductile iron pipe shall be coated with a bituminous coating in accordance with AWWA C-151 requirements.

8.16.6 POLYETHYLENE ENCASEMENT The outside surface of all ductile iron pipe and fittings shall be encased with polyethylene film in tube or sheet form unless otherwise approved by the City Engineer.

The polyethylene film shall be manufactured of virgin polyethylene material conforming to the requirements of ASTM Standard Specification D-1248-68-- Polyethylene Plastics Molding and Extrusion Materials. The film shall have a minimum nominal thickness of 0.008" (8 mils) with a minus tolerance not exceeding 10 percent of the nominal thickness.

The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely air and watertight enclosure. Overlaps shall be secured by the use of polyethylene plastic tape, plastic string, or other materials capable of holding the polyethylene encasement in place under light tension until backfilling operations are completed.

Repair any rips, punctures, or other damage to the polyethylene with polyethylene plastic tape or with a short length of polyethylene tube cut open, wrapped around the pipe, and secured in place.

Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

When valves, tees, crosses, and other odd-shaped pieces cannot be wrapped practically in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges together, folding over twice, and taping down. Tape the polyethylene securely in place at valve stem and other penetrations.

Provide openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene, with tape.

Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least two (2) feet. Secure the end with circumferential turns of tape.

All polyethylene-wrapped pipe, fittings, and valves shall be inspected for proper wrapping by the City Engineer or Public Works Department before backfilling operations.

8.16.7 PIPE INSTALLATION All pipe shall be laid as specified in AWWA Standard for "Installation of Water Mains" except as modified herein and in special conditions approved by the City Engineer.

Tees, elbows, crosses, and reducers shall be used for changes in direction and outlets, unless otherwise specified on the approved detail drawings.

Anchors, thrust bolts and thrust blocks shall be placed at valves, elbows, tees, etc., as shown on the approved detail drawings or as directed by the City Engineer.

All ductile iron pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a non-toxic joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint and gasket surfaces to facilitate easy, positive joint closure.

All pipes shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells and fittings.

Select bedding material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejoined as for new pipe installation. In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with adjoining pipe and to prevent sudden offsets to the flow line. All joint offsets shall be made as specified in AWWA Standard for "Installation of Water Mains" C-900, except as modified herein and in special conditions approved by the City Engineer. As work progresses, the interior of the pipe shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe size, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has set, and pipe shall not be laid when conditions of the trench or weather is unsuitable for such work. At all times when work is in progress, all open ends of the pipe and fittings shall be securely closed to the satisfaction of the City Engineer, so that no water, earth, or other substance will enter the pipe or fittings.

8.16.8 GRAVEL FOUNDATION FOR PIPE USED Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe, the superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or other suitable material as approved by the City Engineer, all such material shall be compacted into place.

Gravel for ductile iron pipe foundations shall be clean gravel with 100% passing a 1 1/2-inch screen and 5% passing a 3/4-inch sieve.

8.16.9 PIPE BEDDING All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded. A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled, with approved bedding material, and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes and pipe fitting holes shall be excavated so that only the barrel of the pipe and bottom quadrant of the fitting receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed six (6) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed into the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped or pushed into the trench in compact masses. Bedding materials shall be loose earth, free from lumps, boulders or other debris; sand materials free from roots, sod, or other vegetable matter. All bedding materials shall be approved by the City Engineer. Pea gravel shall not be accepted as a bedding or backfill material.

In the event trench materials are not satisfactory for pipe bedding, modified bedding materials will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding materials shall be graded as follows: 100% passing a one-inch screen and 5% passing a 1/2" sieve. All modified bedding materials shall be approved by the City Engineer.

8.16.10 CLEANING AND FLUSHING The Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the Contractor. All temporary connections for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor.

All open ends of pipes shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

8.17 POLYVINYL CHLORIDE PIPE (PVC)

8.17.1 GENERAL This specification provides the requirements for Polyvinyl Chloride (PVC) Pressure Pipe with rubber gasket couplings and fittings for water supply and distribution systems. All pressurized irrigation pipe shall be purple in color. Pressurized irrigation main lines shall have a minimum horizontal separation of five (5) feet from any other parallel utility and lip of curb and gutter.

8.17.2 CONFORMANCE PVC pipe shall meet the following requirements:

PRESSURIZED IRRIGATION PRESSURE PIPE AND FITTINGS

Service	Buried
Conformance	Materials ASTM D1784 Latest Edition Manufacturing ASTM D2241, ASTM 1785
Fittings	
3" and larger	Ductile or cast iron mechanical or push on joint with transition gasket, AWWA C-110.
2" and smaller	Solvent cement ASTM D2564, Schedule 40 PVC
Wall Thickness	
8", 10", and 12"	C 900 (DR-18) (Class 200)
4" to 6"	C 900 (DR-18) (Class 200)
2" & 3"	Schedule 40

All PVC pressurized irrigation pipes shall also conform to the latest revisions of the National Sanitation Foundation Testing Laboratories (NSF) specifications.

8.17.3 JOINTS The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of ASTM D-1869. The bell shall be designed to be at least as strong as the pipe wall.

8.17.4 MARKINGS Pipe markings shall include the following, marked continuously down the length:

Manufacturer's name,

Nominal Size,  
Class Pressure Rating,  
PVC Standard,  
NSF Logo (NSF-pw) for Pressurized irrigation pipe, and  
Identification code.

**8.17.5 PIPE INSTALLATION** All PVC plastic pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a non-toxic joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surfaces to facilitate easy, positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Bedding material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and rejoined as for a new pipe. When laying is not in progress, the ends of the pipe shall be closed with a tight-fitting stopper to prevent the entrance of foreign material.

Service lines and laterals must be assembled so that no strain is placed on the pipe during or after backfill operations. After laying of the pipe is completed, it shall be center loaded with backfill and bedding to prevent arching and whipping under pressure. Center loading should be done carefully so that joints will be completely exposed for examination.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

**8.17.6 GRAVEL FOUNDATION FOR PIPE USED** Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with sand, crushed rock, or gravel as approved by the City Engineer, compacted into place.

Gravel for PVC pipe foundations shall be clean crushed rock or gravel with 100% passing a 1-inch screen and less than 5% passing a 1/2" sieve.

**8.17.7 PIPE BEDDING** All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated

or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed six (6) inches in uncompacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compacted masses. Bedding materials shall be loose earth, free from lumps, sand or gravel, free from rocks larger than one-inch diameter; with all materials free from roots, sod, or other organic matter.

8.17.8 MODIFIED PIPE BEDDING In the event trench materials are not satisfactory for pipe bedding, modified bedding will be required. Modified bedding shall consist of placing compacted granular material on each side of and to the level of twelve (12) inches above the top of the pipe.

Modified bedding material shall be graded as follows: 100% passing a one-inch screen and 5% passing a 1/2" sieve, or clean sand may be used to bed and cover PVC pressurized irrigation lines.

8.17.9 CLEANING AND FLUSHING The Contractor shall take every precaution to remove dirt, grease, and all other foreign matter from each length of piping before making connections in the field. After each section of piping is installed, it shall be thoroughly cleaned to remove rocks, dirt, and other foreign matter by washing, sweeping, scraping, or other method that will not harm the lining or pipe.

Water required for flushing shall be furnished by the Contractor unless prior arrangements with the Cedar Hills City Public Works Department have been made. All temporary conditions for flushing and drainage shall be furnished, installed, and subsequently removed by the Contractor.

All open ends of pipe shall be bulkheaded or plugged when workmen are not on the job or in the immediate area to prevent rocks or other foreign matter from entering the pipe.

8.17.10 LUBRICATION Lubrication shall be water soluble, non-toxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacteria growth, and have no deteriorating effect on the PVC or rubber gaskets.

8.17.11 WARNING / LOCATING TAPE AND WIRE A brightly colored warning tape shall be placed in all trenches where PVC pipe is used. The non-potable marked foil tape

shall be placed 12 inches above all pressurized irrigation main lines. Tape for the pressurized irrigation pipe shall be blue with the word pressurized irrigation along the tape. A #10 gauge insulated copper tracing wire shall also be laid directly below each main pressurized irrigation line and service lateral and connected to all valves or valve boxes for locating purposes as shown in Standard Drawing No. 502.

## 8.18 VALVES

Valves shall be of cast iron body, bronze-mounted, parallel seat, non-rising stem design with o-ring seals. Valves shall be AFC, Mueller or equivalent. Valves shall be attached to flanged tees or crosses at intersections. The maximum gate valve size shall be 10 inches. All valves 12 inches or larger shall be butterfly valves.

8.18.1 GATE VALVES Gate valves shall conform to AWWA Specification C500. Unless otherwise shown or specified, valves shall be of mechanical joint connection design for buried service. Buried valves shall have two-inch operating nuts. All gate valves ten (10) inch and smaller shall be of resilient seat type. Valves shall have a minimum working pressure of 200 psi.

8.18.2 BUTTERFLY VALVES Butterfly valves shall conform to AWWA Specification C504 Class 250. Both valved ends shall be mechanical joint per AWWA Specification C111, and accessories (bolts, glands, and gaskets) shall be included.

8.18.3 VALVE BOXES All buried valves shall be installed complete with a cast iron, two-piece, slip top, 5-1/4 inch shaft valve box. Triangular lids shall be used and the word "Irrigation." shall be cast on the cover. All valve boxes located in streets shall be installed as closely to street grade as possible.

8.18.4 BACKFILL All valve clusters shall be backfilled with gravel to the bottom of the road base and consolidated in 2' maximum lifts.

8.18.5 BLOW-OFF VALVES All blow-off valves shall be constructed as per standard drawing No. 405.

## 8.19 SERVICE LATERALS

8.19.1 PIPING Pipe for pressurized irrigation services shall be 160 psi type "K" copper water tubing or approved equal, with a one-inch inside diameter or larger. All service laterals shall be laid in Purple CTS Poly Pipe, no other colors will be accepted.

All fittings shall be brass; galvanized fittings will not be accepted.

8.19.2 LAYING All service laterals shall be laid on property corners with a 1½ inch CTS Poly Pipe 2 to 3 feet behind the sidewalk tee'd into 1 inch connections stubbed 3 feet from tee to each lot.

8.19.3 BEDDING All service laterals shall be bedded in sand or approved equal.

8.19.4 CORPORATION STOPS Connections to main lines shall be through a corporation type stop of AWWA thread type with flared copper connection of Mueller H-15000 type or approved equal. Metal inserts "stiffners" shall be used in all service lateral connections. One (1) inch curb stop valves or stop and waste valves shall be installed at the end of each service lateral. Ball valves will not be accepted. Valves on the service lateral shall be laid flat in green irrigation boxes with irrigation lids.

## 8.20 BACKFLOW PREVENTION DEVICES

Backflow prevention devices shall be installed on all pressurized irrigation service connections in conformance with requirements of the Uniform Plumbing Code Chapter 10 (Appendix J). All testing, maintenance, and/or repair shall be performed by certified backflow assembly technicians.

### 8.21 TESTING PRESSURIZED IRRIGATION LINES

8.21.1 GENERAL Any and all pressurized irrigation main lines and service laterals that are replaced, installed, or repaired, to include fire hydrants, shall be tested and flushed as outlined in this section.

8.21.2 TESTING Tests shall be made upon completion of system installation, replacement, repair, or any valved portion thereof. All tests shall be made at the expense of the Contractor and in the presence of the City Engineer or the City Water Superintendent. All testing shall meet or exceed the minimum requirements for Department of Environmental Quality Safe Drinking Water Rules.

Lines shall be slowly filled with water venting off all air. If required, taps shall be provided at line high points to bleed off the air and after testing these shall be plugged. A minimum pressure of 200 PSI shall be maintained on the portion being tested for a minimum period of two hours, using hydraulic means to maintain the pressure.

8.21.3 FLUSHING After pressure testing all pipelines shall be flushed. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the Contractor shall install a tap of sufficient size to provide for a 2.5 foot per second flushing velocity in the line. The following is the flow quantity required to provide a 2.5 foot per second flushing velocity:

Pipe Size <u>(in.)</u>	Flow <u>(gpm)</u>
---------------------------	----------------------

2	25
4	100
6	220
8	390
10	610
12	880
16	1567