

SECTION 8

WATER PIPING SYSTEMS

8.1 DESCRIPTION

A. General:

This work consists of furnishing and installing water mains, service lines, and appurtenances. This includes all equipment, tools, materials, labor, and other incidentals to provide water mains and service lines complete and ready for immediate and continuous use. The work includes, but is not limited to, all necessary excavation, backfilling, compaction, testing, clean up, and restoration required for a complete installation of water mains, service lines, and appurtenances.

B. Definitions:

1. Distribution main means a water main that supplies one or more branch mains.
2. Fire Service Line means pipe and appurtenances delivering water from the City water distribution system to a building fire extinguishing system. Fire service lines may be located on private property or in public ROW and are owned, operated, and maintained by the property being served.
3. Fire hydrant lead means that portion of the fire hydrant branch line from the main to the fire hydrant auxiliary valve.
4. "L" length for Joint restraining devices means the length of pipe from a fitting, valve, or feature that needs to have each pipe joint within that length restrained.
5. Private Fire Protection System means hydrants, valves, water pipes, and appurtenances, sprinkler systems, hose connections, and other equipment constructed for the purpose of providing fire protection for a building or group of buildings and supplied with water from a public water supply system. Private Fire Protection Systems are located on private property, although some components may be located in public ROW, and are owned, operated, and maintained by the property being served.
6. Transmission Main means a water main that supplies many tributary branches, serves a large area, and has few taps.
7. Water mains are those pipes of at least six (6) inches in diameter, which will be installed in public right-of-way or easements and will become a part of the City water distribution system and which will be owned, operated, and maintained by the CITY OF RAPID CITY.

8. Water service line shall mean the line from the main to within five (5) feet of the building and is owned and maintained by the owner of the property being served. The service line then connects to the Property Water Distributing System. For purposes of this definition, it is understood that the building or premises "Property Water Distributing System" begins 5 feet outside of the building and will usually be the same pipe material as the water service line up to where it actually enters the building.
9. Property Water Distributing System is those pipes within the building or the premises, which convey water from the water service pipe to the point of use. For purposes of this definition, the Property Water Distributing System begins 5 feet outside of the building and will usually be the same pipe material as the Water Service Line up to where it actually enters the building.

C. Related Work:

- Section 7 - General Conditions
- Section 9 - Sanitary Sewer ~~Mains~~
- Section 11 - Utility Excavation and Backfill
- Section 41 - Utility Trench Resurfacing
- Section 56 - Concrete for Incidental Construction (Class M)
- Section 90 - Traffic Control
- Section 112 - Select Granular Backfill
- Section 200 - Controlled Low Strength Material

D. License and Permit Requirements:

Refer to Section 11.

E. Submittals:

Submittals shall be required unless otherwise specified in the Detailed Specifications or Special Provisions. The term "Submittals" includes, but is not necessarily limited to, manufacturer's product data sheets of pipe, appurtenances, and fittings. Submittals shall be submitted for, but not limited to, the following items:

Fire hydrants, pipe, pipe fittings and their appurtenances including T-bolts, joint restraints, polyethylene encasement, and any other pertinent information concerning construction materials that the Engineer deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.

All submittals shall be made in accordance with Section 7.

Resubmittals shall be made in the same manner as submittals, with changes clearly shown.

8.2 MATERIALS

A. Pipe:

General: Pipe for water mains shall be Polyvinyl Chloride (PVC) or ductile iron with push on joints as specified on the plans or in the Detailed Specifications. Water pipe 4 1/2 in. and larger shall be ductile iron pipe unless indicated otherwise on the drawings or in the specifications.

1. PVC pressure pipe, 4 inches through 12 inches, shall conform to the requirements of AWWA Specification C-900, Class 150 or Class 200, (C.I.O.D.) and meet one of the below standards.
 - a. PVC pipe shall have bell ends with elastomeric gaskets. Pipe joints shall use the Rieber joining system, which has the gasket formed into the pipe during the pipe manufacturing process. Installation procedures shall conform to AWWA C-605 Standards or
 - b. PVC pipe shall be Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation or equal. Pipe joints shall utilize non-metallic couplings with locking splines. High strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360° restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F 477. Joints shall be designed to meet the zero leakage test requirements of ASTM D 3139. Every pipe and coupling shall pass the AWWA C900 hydrostatic proof test requirements of 4 times the pressure class for 5 seconds. Pipe and Couplings shall meet all approvals per Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation and all pipe and couplings shall be marked in accordance with the requirements established for Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation.
2. PVC pressure pipe, 14 inches through 36 inches, shall conform to the requirements of AWWA Specification C-905, Pressure Rated 165psi, DR 25 (C.I.O.D.) unless otherwise specified. PVC pipe shall have bell ends with elastomeric gaskets. Pipe joints shall use the Rieber joining system, which has the gasket formed into the pipe during the pipe manufacturing process. Installation procedures shall conform to AWWA C-605 Standards.
3. Ductile iron pipe shall conform to the requirements of AWWA Specifications C-150 and C-151, Pressure Class 350 for 3 inches through 12 inches diameter, Pressure Class 250, or greater for 14 inches through 20 inches diameter, and Pressure Class 200, or greater for 24 inches and larger diameter, unless specified otherwise on the plans or Detailed Specifications. Ductile iron pipe shall be coated on the outside with a bituminous coating 1-mil thick, minimum,

and shall be cement-mortar lined in accordance with AWWA Specification C-104. Linings shall be full thickness to the end of the spigot and to the seat of the bell, or shall be tapered for a length of not more than two inches.

Rubber gasket joints for all Ductile Iron pipe shall meet the requirements of AWWA C-111. Installation procedures shall conform to AWWA C-600 Standards.

4. Water service pipe 1 inch through 2 inches diameter shall be Type "K" soft copper tubing; 4 inches and larger service pipe shall be PVC or ductile iron pressure pipe as specified for water pipes, above.

Type K soft copper tubing shall be US Government Type K Soft Tubing in 60 – foot single or double pancake coils for 1 inch and 1 ½ inch diameter material. The minimum center coil diameter shall not be less than 16 inches.

Tubing material for 2 inches material shall be supplied in 20 – foot lengths with ends of tubing to be cut off evenly. Two (2) Inches coiled material will not be accepted.

Water service pipe larger than 2 inches shall meet the specifications above for PVC pressure pipe or ductile iron pipe.

B. Fittings:

1. Water main fittings:

General: Fittings used with ductile iron pipe shall be ductile iron. Fittings 12 inches and smaller, used with PVC pipe shall be ductile iron or PVC.

All bolts and nuts shall conform to AWWA C111 and ASTM – A325 Type 3. The bolts and nuts shall be Cor-Blue, fusion bonded epoxy, Series 300 stainless steel or approved equal. Coated bolts and nuts shall be “near white” or “white” metal with 8 to 10 mil minimum coating thickness. Fitting types applicable to this specification consist of bends, crosses, tees, reducers/increasers, plugs, caps, couplings, and sleeves.

- a. Ductile Iron water main fittings: Fittings shall be ductile-iron with 350-psi pressure rating and rubber gasket joints meeting all applicable requirements of the latest edition of AWWA C110, C111, and/or C153 Specifications. All internal and external ferrous surfaces shall be coated with a minimum 6 mil thick fusion bonded epoxy coating applied electrostatically and at a minimum shall meet the requirements of AWWA C116.

Unless specified otherwise on the plans or Detailed Specifications the following fitting joint shall be provided:

- Fittings 8 inches and smaller shall be push-on joint.
- Fittings 10 inch and 12 inch shall be push-on joint or mechanical joint. If the fitting is going to be restrained then it shall be a mechanical joint.
- Fittings 14 inches and larger shall be mechanical joint.

Push-on joint fittings shall be furnished with restraining lugs. The lug pattern for all sizes shall accommodate gripper-type restrainers.

~~Unless specified otherwise on the plans or Detailed Specifications, fittings 12 inches and smaller shall be push-on joint and fittings 14 inches and larger shall be mechanical joint. Push-on joint fittings shall be furnished with restraining lugs. The lug pattern for all sizes shall accommodate gripper-type restrainers.~~

- b. PVC water main fittings: PVC fittings maybe used in-lieu of ductile iron fittings for PVC pipe installations 12 inches and smaller. PVC fittings shall meet all applicable requirements of the latest edition of AWWA C900 Pressure Class 150 and AWWA C907. The PVC fitting bell ends shall have elastometric gaskets. Installation procedures shall conform to AWWA C-605 Standards.
- c. Couplings: Straight and transition couplings shall be Romac Style 501 as manufactured by Romac Industries, Inc., or equal and shall have ductile iron center rings and end rings meeting ASTM A536-80, Grade 65-45-12. Center rings shall be epoxy coated. Gaskets shall be SBR compounded for water service. Certa-Lok C900/RJ Restrained Joint PVC Pipe manufactured by CertainTeed Corporation or equal shall use non-metallic couplings specifically designed by the manufacture for use with their pipe. Couplings for 12 inch and larger pipe shall be a minimum 12 inches in length.
- d. Tapping Sleeves shall be ductile iron or stainless steel, flanged branch ends, with test plugs for pressure testing. The Sleeve shall be approved for use at pressures equaling or exceeding those of the pipe classification being installed. Ductile iron tapping sleeves shall be mechanical joint with totally confined end gaskets. Stainless steel tapping sleeves shall have a 304 stainless steel shell with SBR gaskets compounded for water service, a stainless steel flange, and shall have 304 stainless steel nuts, bolts, and washers.

C. Valves:

General: Valves 16 inches and smaller shall be gate valves and valves 18 inches and larger shall be butterfly type or gate valves as specified on the plans or detailed specifications.

-All internal and external ferrous surfaces shall be coated prior to assembly with a minimum of 6 mils of fusion bonded epoxy coating applied electrostatically prior to assembly meeting the requirements of AWWA C550.

Additionally an exterior coating of Polyurea/Polyurethan Hybrid Resin per American AVK Company, or equal maybe added to the epoxy coatings required above.

Bolts and nuts shall be Cor-Blue, fusion bonded epoxy, Series 300 stainless steel or approved equal

1. Gate Valves shall conform to the requirements of AWWA Standard C509 and C515 with a 250-psi pressure rating and shall have a ductile iron-body and bonnet, be resilient seated, utilize mechanical joints including gaskets and bolts, and include all accessories. ~~Bolts shall be Cor-Blue, fusion bonded epoxy, Series 300 stainless steel or approved equal. All internal and external ferrous surfaces shall be coated prior to assembly with a fusion bonded epoxy coating applied electrostatically prior to assembly meeting the requirements of AWWA C550.~~ Gate valves shall have ductile iron wedge fully encapsulated with a SBR rubber or Nitrile elastomer coating. Stems shall be non-rising; one piece cast, forged or rolled bronze. Valves shall have two (2) inches ductile iron operating nuts and shall open left, counter clockwise. Bonnet bolts and nuts shall be Series 300 stainless steel and shall be rust proofed after threading and final tightening.
2. Butterfly Valves shall conform to the requirements of AWWA C504, Class 150B for buried installation. ~~All internal and external ferrous surfaces shall be coated prior to assembly with a fusion bonded epoxy coating applied electrostatically prior to assembly meeting the requirements of AWWA C550.~~ Butterfly valve box body and disk shall be ductile iron ASTM A-536. Shaft shall be stainless steel. Seat shall be Buna-N, field replaceable without special tools and shall provide tight shutoff as required by AWWA C504. Mating surfaces shall be stainless steel. Bearings shall be self-lubricating, corrosion-resistant, and shall be designed for horizontal and/or vertical shaft loading. Shaft seals shall be designed for the use of bi-directional, self-adjusting packing, replaceable without removing the valve shaft.

Actuator shall be designed for buried service and shall be grease-packed, totally sealed. Actuator shall be equipped with a mechanical stop-limiting device to prevent over-travel of the valve disc in the open and closed positions. Actuator shall be equipped with 2 inches operating nut, which is hex-mated to the input stem and shall open by turning counter-clockwise. ~~Bolts shall be Cor-Blue, fusion bonded epoxy, Series 300 stainless steel or approved equal.~~

D. Valve Boxes:

1. Gate Valves 10 inches and smaller and Butterfly Valves:

Valve Boxes shall be Mueller 666-S or equal and shall be a 2-piece screw-type construction with five and one-fourth (5 1/4) inches riser and shall be adjustable from four and one half (4 1/2) feet to six (6) feet, with the top section to be at least 24 inches in length. Drop lids shall be marked "Water" and are to be of all-metal construction.

2. Gate Valves: 12, 14, and 16 inches.

Valve Boxes shall be Mueller 666-S or equal and shall be a 2-piece screw-type construction with five and one-fourth (5 1/4) inches riser and shall be adjustable from three (3) feet to four and one half (4 1/2) feet, with the top section at least 24 inches in length. Drop lids shall be marked "Water" and are to be of all-metal construction.

3. Valve Box Adaptor:

A valve box adaptor shall be installed on the valve bonnet prior to installing the valve box. The valve box adaptor eliminates shifting of the valve box, protects the coatings, centers the valve box, and seals the valve box with a resilient material. The adaptor shall be installed in lieu of hardwood blocking and shall be incidental to the valve box. The valve box adaptor shall be installed per the manufacturer's recommendations. The valve box adaptor shall be a "Valve Box Adaptor II" as manufactured by Adaptor Inc., a "Valve Box Self-Centering Alignment Ring" as manufactured by American Flow Control, or an approved equal.

E. Fire Hydrants:

Fire hydrants shall meet AWWA Standard C-502 and shall be Mueller A-423, American Darling B84B, American AVK Series 27, or Waterous WB-67 Pacer, traffic model with 6 ft. bury and 6 inches mechanical joint inlets. Hydrants shall have 5 1/4 inches minimum valve openings, having O-ring packings and oil chamber to hold soft oil for stem thread lubrication, and shall have all operating parts, including valve seat, removable through the barrel. Barrel and upper standpipe shall be ductile iron with breaker flange and operating stem at ground level. A steel breakaway coupling shall be installed on the operating stem so that in case of breakage, no damage will result to the fire hydrant other than safety breakers.

All internal and external ferrous surfaces shall be coated with a minimum of 6 mils of fusion bonded epoxy coating applied electrostatically and at a minimum shall meet the requirements of AWWA C550 and AWWA C116 as applicable.

All external ferrous surfaces below the fire hydrant "bury line" including the fire hydrant riser (barrel) sections and adjoining 90 degree ells shall be coated with HB

Fuller IF1947T Red Oxide Powder, Tnemec Series 140 Pota-Pox Epoxy or equal meeting the requirements of AWWA C550 and AWWA C116 as applicable.

Additionally an exterior coating of Polyurea/Polyurethan Hybrid Resin per American AVK Company, or equal maybe added to the epoxy coatings required above.

All exposed nuts and bolts below the breakaway (direct bury) shall be series 300 stainless steel.

All hydrants shall be capable of being extended in six (6) inches increments. However, the minimum hydrant adjustment shall be 12 inches.

Hydrants shall be constructed so that they will close with the existing water pressure acting on the hydrant. Drain valves shall be bronze and shall be positively operated by the main operating rod. All threads shall be National Standard threads. Operating nuts shall be 1 ½ inches point-to-flat, pentagon (National Standard). Hydrants shall open left, counter clockwise. Fire Hydrants shall have an internal travel stop nut.

Hydrants are to have two (2), two and one-half (2 1/2) inches nozzles and one (1) four and one-half- (4 1/2) inches steamer nozzle, all with National Standard threads. The minimum distance from the hydrant breaker flange to the centerline of the lower nozzle shall be sixteen (16) inches. Caps shall be nut type and shall be provided with chains. Hydrants shall be painted fire hydrant red.

All Fire Hydrants are to be ordered with barrel lengths of six (6) to eight (8) feet to facilitate their installation per the grades and lines shown on the drawings. Adjustments greater than eight (8) feet shall be accomplished using vertical bends (45, 22½, or 11¼) along the hydrant lead. The use of a Fire Hydrant Extension will not be an acceptable method of adjustment for a new Fire Hydrant, provided the necessary information was communicated on the drawings or specifications. If this information was communicated and the hydrant requires adjustment for final grade, then the Contractor shall replace the Fire Hydrant with a new Fire Hydrant with the correct barrel length or install the appropriate vertical bends on the hydrant lead.

In cases where a Fire Hydrant Extension will be installed, the Contractor shall furnish the appropriate extension and notify the City Utility Maintenance Department for installation. City crews shall install all Fire Hydrant Extensions.

F. Service Line Valves and Fittings:

General: Service line valves and fittings shall meet AWWA Standard C-800 and ASTM B26. All castings shall be 85/5/5/5 copper alloy.

1. Service line copper splicing couplings shall be flared or compression type such as Mueller 110 Conductive Compression, Hayes-Tite, or equal. Soldered joints shall not be used for service lines installed underground.

2. Curb stop valves shall be a “ball valve” type with a 300-psig working pressure rating. A double O-ring port seal shall be provided in the stem and the O-rings shall be supported in precision-machined grooves. The end pieces shall be O-ring sealed to provide additional protection against leaking. 90-degree valve operation, with internal movement restraint, is required. Drains are not permitted on valves. Buffalo type valve boxes are required and therefore the Minneapolis Pattern threads on the valve are not a requirement.

Copper pipe connections shall be Mueller 110 Conductive Compression, A. Y. McDonald McQuick Compression – Q Series, Hayes-Tite, or equal.

Curb stop valves shall be:

- “Mueller 300 Ball Curb Valve” with “Mueller 110 Conductive Compression Connection”; model B-25155,
- “A. Y. McDonald Minneapolis Pattern Ball Valves – 300 PSIG Water”; model 6104Q or 6100Q,
- Ford B44 Series,
- Or equal.

3. Corporation stops shall be a “ball valve” type with a 300 psig working pressure rating. The inlet shall have a taper thread (AWWA Standard) and the outlet shall be a conductive compression connection for type "K" copper. Copper pipe connections shall be Mueller 110 Conductive Compression, A. Y. McDonald McQuick Compression – Q Series, Hayes-Tite, or equal.

Corporation stops shall be:

- “Mueller 300 Ball” with “Mueller 110 Conductive Compression Connection”; model B-25008,
- “A. Y. McDonald Ball Valves – 300 PSIG Water”; model 4701BQ,
- Ford FB1000 Series,
- Or equal.

[Corporation stops that are used to connect copper water services to metallic water mains shall be the isolator style or insulated corporation ball valve.](#)

4. Service Saddles: Service saddles for 1 inch through 2 inches copper service pipe shall utilize a wide band/strap with a minimum of two (2) bolts and nuts, per width of the band/strap, for securing the band/strap to the main. The saddle shall provide full support around the circumference of the pipe. Nuts and bolts shall be rolled thread stainless steel or silicon bronze. Gaskets shall be neoprene or NBR compounded for water service.

- a. It shall be the Contractors responsibility to ensure that saddles and corporation stops are compatible with the pipe on which they are to be installed. If a compatibility question arises, the Contractor shall inform the Engineer and provide him with a recommended substitution.

b. Saddles for 6 inch – 12 inch mains:

Saddles 6 inches – 12 inches mains shall utilize a stainless steel, cast brass per ASTM B62, bronze, or a high strength ductile iron body with a minimum 12 mils of fusion applied epoxy or Nylon 11 coating and a stainless steel band.

Saddles shall be pre-sized if required or recommended by the saddle or pipe manufacturer. Pre-sized saddles will conform to the pipe O.D. without placing undue stress on the PVC pipe. Not all of the following indicated saddles are presized and it is the responsibility of the Contractor and supplier to ensure that the saddle is presized if required or recommended by the saddle or pipe supplier.

Saddles for 6 inch – 12 inch mains shall be:

- 1 inch Service Taps:
Provide a minimum total band/strap width of 2 inches along the axis of the pipe. Saddles for 1 inch taps on 6 inches – 12 inches pipe shall be Ford Style FS303 or FC202, Romac Style 306, Style 202N and 202BS with SS straps, A. Y. McDonald Model 3845, Mueller DR2S series with double studs, or approved equal.

- 1½ inches & 2 inches Service Taps:

Provide a minimum total band/strap width of 3¼ inches along the axis of the pipe. Saddles for 1½ inches & 2 inches taps on 6 inches – 12 inches pipe shall be Ford Style FS303 or FC202, Romac Style 306, Style 202N and 202BS with SS straps, A. Y. McDonald Model 3845, Mueller DR2S series with double studs, or approved equal.

c. Saddles for 14 inch and larger mains:

Saddles for 14 inches and larger mains shall utilize a stainless steel, cast brass per ASTM B62, bronze, or a high strength ductile iron body with a minimum 12 mils of fusion applied epoxy or Nylon 11 coating and a stainless steel band.

Saddles shall be pre-sized if required or recommended by the saddle or pipe manufacturer. Pre-sized saddles will conform to the pipe O.D. without placing undue stress on the PVC pipe. Not all of the following indicated saddles are presized and it is the responsibility of the Contractor and manufacturer to ensure that the saddle is presized if required or recommended by the saddle or pipe supplier.

Saddles for 14 inch and larger mains shall be:

- 1 inch Service Taps:

Provide a minimum total band/strap width of 2 inches along the axis of the pipe. Saddles for 1 inch taps on 14 inches and larger pipe shall be Ford Style FC202, Romac Style 202N and 202BS, and Mueller DR2S, with SS ~~straps, or straps, or~~ approved equal.

- 1½ inches & 2 inches Service Taps:

Provide a minimum total band/strap width of 3¼ inches along the axis of the pipe. Saddles for 1½ inches & 2 inches taps on 14 inches and larger pipe shall be Ford Style FC202, Romac Style 202N and 202BS, and Mueller DR2S with SS straps, or approved equal.

5. Curb boxes shall be Tyler 6500 series, Mueller H-10350, Buffalo type, or equal and shall be cast-iron. The box shall be capable of telescoping, at a minimum, from five (5) feet to a length of six (6) feet. Lid shall be marked "water" and have a 13/16 inches (point to flat) pentagon brass nut. Risers shall be a minimum of two-and-one-half- (2 ½) inches in diameter.
6. Tapping sleeves and valves shall be used for service lines larger than 2 inches.

G. Concrete Thrust Blocks:

Thrust blocks shall be M-6 (4000 psi) concrete as specified in Section 56 of these specifications.

H. Joint Restraining Devices

1. Joint Restraint Devices at Fittings shall meet the following requirements:

In general, solid ring restraints shall be used whenever possible. Split restraints may be used when connecting to existing systems, for special cases, and when a solid ring restraint is not available for the application. All joint restraint devices shall be epoxy coated (min. 6 mils), utilize the "E Coat" coating system as specified by the Ford Meter Box Co., Inc., or utilize the "Mega-Bond" coating system as specified by EBBA Iron, Inc. All bolts, rods, etc. shall be COR-Blue, epoxy coated, stainless steel, or fluoropolymer coated per EBBA Iron, Inc. and the Ford Meter Box Co., Inc. specifications.

- a. For DI pipe to DI push-on fittings:

Fitting Joint Restraints shall be EBAA Series 1100HD, or equal.

- b. For DI pipe to DI MJ fittings:

Fitting Joint Restraints shall be EBAA MEGALUG Series 1100, Series 1100SD, or equal.

- c. For PVC pipe to DI push-on fittings:

Fitting Joint Restraints shall be EBAA Series 15PF00, or equal.

- d. For PVC pipe to DI MJ fittings:

Fitting Joint Restraints shall be EBAA Series 2000PV, Series 2000SV, Series 15PF00, or equal.

- e. For PVC pipe to PVC push-on fittings:

Fitting Joint Restraints shall be EBAA Series 2500, or equal.

2. Joint Restraint Devices at pipe bells shall meet the following requirements:

In general, solid ring restraints shall be used whenever possible. Split restraints may be used when connecting to existing systems, for special cases, and when a solid ring restraint is not available for the application. All joint restraint devices shall be epoxy coated (min. 6 mils), utilize the "E Coat" coating system as specified by the Ford Meter Box Co., Inc., or utilize the "Mega-Bond" coating system as specified by EBBA Iron, Inc. All bolts, rods, etc. shall be COR-Blue, epoxy coated, stainless steel, or fluoropolymer coated per EBBA Iron, Inc. and the Ford Meter Box Co., Inc. specifications.

- a. For ductile iron pipe:

The bell restraint shall be EBAA Series 1700, or equal.

In lieu of bell restraint devices, push on joints with the American Fastite Joint system with Fast Grip Gasket, or equal may be used when approved by the Engineer.

- b. For PVC C-900 pipe:

The bell restraint shall be EBAA Series 1600, or equal.

- c. For PVC C-905 pipe:

The bell restraint shall be EBAA Series 2800, or equal.

- I. Polyethylene Encasement:

Polyethylene Encasement (poly-wrap) shall meet AWWA C-105.

For ductile iron pipe, the encasement shall be 8-mil thickness, seamless tube, black ASTM D-1248, Type 1, Class C, Grade G-1. Joint tape for encasement shall be 3M Scotchwrap 50, or equal.

For fittings and joint restraining ~~devices which~~ devices, which are not epoxy coated, the encasement shall be 8-mil thickness sheet polyethylene meeting AWWA C-105. Joint tape for encasement shall be 3M Scotchwrap 50, or equal.

J. Pipeline Insulation:

Pipeline insulation shall be Type IV Styrofoam Brand—"Square Edge" or "Score Edge" as manufactured by Dow Chemical Company or approved equal shall be used for insulating water pipes where required. The total thickness and dimensions shall be specified on the drawings or in the Specifications. The minimum insulation thickness however shall be 2 inches.

Approved equal products from other manufacturer's shall be Extruded-Polystyrene Board Insulation formed from polystyrene base resin by an extrusion process using hydrochlorofluorocarbons as blowing agent to comply with ASTM C578, Type IV, with 1.60 lb./cu. Ft. minimum density and a compressive strength of 25 lb./ sq. in as specified in ASTM D1622 and ASTM D1621 respectively. The maximum thermal conductivity of the insulation shall conform to ASTM C518, C177, and C578. The maximum water absorption percentage by volume shall be 1% in accordance with ASTM D2842. The range of water vapor permeance shall be 0.4 to 1.0 perm in accordance with ASTM E96.

K. Meter, Air Release, and Valve Pits:

Meter, air release, and valve pits shall be constructed in accordance with the detailed drawings and unless specified otherwise on the Drawings or Detailed Specifications, the pits shall be constructed in accordance with precast concrete manholes as specified in Section 9, Sanitary Sewer and modified as follows.

Meter, air release, and valve pits shall be provided with steps. Flat cover slabs, when required, shall be designed for HS-20 loading and shall have an offset 24 inches diameter hole in line with the manhole steps. Cones shall have an offset 27 inches diameter hole in line with the manhole steps. Standard frames and covers shall be "Neenah 1758 – E Frost – Retardant Frame and Lid w/ Inner Lid", or equal unless otherwise indicated on the drawings or specifications. The Lid shall be a diamond top design "Neenah Type C" un-marked.

Otherwise, the pit and casting shall meet the requirements of Section 9, Sanitary Sewer.

L. Tracer Wire System:

Tracer Wire shall be a direct bury wire that meets or exceeds the following requirements:

- a. Conductor: 12 AWG solid strand soft drawn copper per ASTM B-3, or B-8. The breaking pounds of the wire shall be a minimum of 124 with an O.D. of 0.154. All wire shall be spark tested at 7500 VAC.

- b. Insulation: Conductor shall be insulated with low density high molecular weight polyethylene insulation suitable for direct bury applications per ASTM D-1248. The minimum insulation thickness shall be 0.045. The color of the insulation shall be blue with a print line saying "WATER".
- c. Splices and or Connectors: Splices and or Connectors should be capable of handling from 2 to 4 wires per connector and designated as "water-proof". PVC adhesives or sealing compounds are not acceptable.
- d. Tracer Wire Access Box: Tracer wires shall be terminated using a small terminal box suitable for flush burial with a 2½ inches lockable cast iron top, integral stainless terminals and a minimum 12 in. ABS bottom section.
- e. Tracer Wire System Manufactures:
 - Tracing Wire – Kris Tech Wire Co. Inc., Paige Electric Corporation, or equal.
 - Splice Kit/Connectors -3M epoxy type compounds, fusible heat shrink tubing, 3M DBY connectors, or Snaploc LV 9000 direct bury wire connectors, or equals.
 - Tracer Wire Access Box – Valvco Pipe Tracer Wire Terminal Box or equal.

8.3 CONSTRUCTION REQUIREMENTS

A. Materials Handling and Storage:

The Contractor shall be responsible for the safe handling and storage of all materials furnished by them and shall replace, at their expense, all such materials found defective in manufacture or damaged in transportation, handling, or storage.

Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall such materials be dropped. All material shall be stored in a neat and orderly manner. Pipe shall be stored, to the greatest extent possible, in unit packages or bundles and shall be handled to prevent stress to bell joints and prevent damage to bevel ends. In addition, materials shall be handled and stored in accordance with manufactures' recommendations.

If in the opinion of the Engineer damage or defects to the factory applied external coatings on steel or ductile iron pipe and fittings (including fire hydrants) can not be repaired, then the Contractor shall replace the damaged items with new materials.

If in the opinion of the Engineer damage or defects to the factory applied external coatings on steel or ductile iron pipe and fittings (including fire hydrants) can be repaired, then the Contractor shall make said repairs as follows:

If approved by the Engineer, the Contractor may make repairs when damage or defects occur in the factory applied external epoxy or "MEGABOND" coatings supplied on steel or ductile iron pipe and fittings (including fire hydrant risers and joint restraint devices). Coating repairs shall be made using a high build, low temperature applicable, fast cure, liquid epoxy coating. This epoxy coating material shall be Protal 7125 Repair Cartridge in packaged two component tubes with dispensing gun as manufactured by DENSO North America Inc.

When high ambient temperatures (i.e., > 85 degrees F) occur or when metal surface skin temperatures are high (i.e., > 100 degrees F) such that use of the DENSO Protal 7125 Repair Cartridge may be difficult due to the very short handling time of the material, an alternate modified amine cured epoxy coating may be used. This alternate coating shall be TC 7010 FS-Gray fast setting epoxy coating as manufactured by Tapecoat Co.

B. Alignment and Grade:

Pipe shall be laid true to the line and grade established on the Drawings. Where the Drawings indicate that the finished ground surface elevations are to be modified from the existing elevations by this or future construction, the Contractor shall exercise care to ensure that pipe, fittings, hydrants, valves and valve boxes are placed to the elevations indicated on the plans.

C. Underground Obstructions:

The Contractor shall expose existing underground obstructions shown on the plans or located in the field and shall determine their elevations far enough in advance of pipe laying that the proposed water main can be installed without the use of fittings at or near the points of crossing. Wherever obstructions not shown on the plans are encountered during the progress of the work and interfere with the proposed horizontal or vertical alignment of the pipeline, the Engineer will change the plans and order a deviation in the line and/or grade, or may arrange for the removal or relocation of the obstructions. The Contractor shall not deviate from plan line or grade without the Engineer's approval.

D. Water Main and Sewer Main/Storm Sewer Separation:

1. Vertical Separation at Crossings:

Water mains may cross above sanitary and storm sewers with a minimum vertical distance of eighteen (18) inches between the invert of the water main and the top of the sewer. In these cases where the water main is above the sewer and there is at least 18 in. of separation, then at the crossings one full 20 ft. length of water pipe shall be centered on the crossing.

The following installation requires Engineer's approval and is appropriate for installations where the water main ~~can not~~ cannot be constructed (18) inches above the sewer.

A water main may cross above a sewer main with a vertical separation of less than eighteen (18) inches or below the sewer main if either the water or sewer main is encased in PVC, ductile iron, or six (6) inches of "Controlled Low Strength Material" ~~concrete~~ concrete for at least ten (10) feet each side of the crossing. If PVC or ductile iron is utilized as encasement material, the ends shall be sealed with six (6) inches of Class M5 concrete.

~~Water mains crossing under vitrified clay sewer pipes or concrete sewer pipes shall be encased in six (6) inches of concrete extending ten (10) feet either side of the crossing.~~

The 10 feet ~~each side of the crossing either side~~ shall be measured from the outside wall of the sewer to the end of the encasement and is not measured from the centerline of the sewer main.

2. Water Main and Sewer Main/Storm Sewer Horizontal Separation:

Water mains shall be constructed with a minimum of 10 feet of horizontal separation from any existing sanitary or storm sewer or proposed sanitary or storm sewer. The 10 feet horizontal separation shall be the clear distance (water pipe sidewall to sewer pipe sidewall) and not the centerline distance between the utilities.

The following installation requires Engineer's approval and is appropriate for installations where the 10 feet separation physically is not possible.

A water main may be constructed closer than 10 feet to a Sanitary or Storm sewer if it is laid in a separate trench or it is laid in the same trench and the water main is located on the opposite side on a bench of undisturbed earth. In both cases, the elevation of the crown of the sewer has to be at least 18 inches below the invert of the water main. The sewer main shall be constructed of water main pipe (pressure class pipe) meeting the requirements of Section 8.2 and

pressure tested for water tightness in accordance with AWWA standards for leakage testing.

As an alternative to constructing the sewer with water main pipe (pressure class pipe) and pressure testing the sewer, it would also be acceptable to either encase the water or sewer main with 6 inches of "Controlled Low Strength Material" concrete or to encase either the water or sewer within a PVC or cast iron casing.

3. Manholes and Storm Sewers:

Sanitary Sewer Manholes and Storm Sewer Pipes and Inlets are considered to be sewers in regards to the above separation requirements.

A water main may ~~can~~ be constructed below, within ~~the~~ 10 ft. horizontally, and within 18" above ~~separation from~~ a Storm Sewer pipe or Storm Sewer Inlet provided that the Storm Sewer pipe is constructed with sealed joints and passes a low-pressure (5psi) pressure test. The pressure test shall be maintained for a minimum of 30 minutes. The pressure test shall otherwise comply with the requirements of the "Low Pressure Air Test" in Section 9.3.H.4.a Sanitary Sewer.

The "Low Pressure Air Test" maybe waived by the Engineer for round RCP storm sewer utilizing O-ring gasketed joints as manufactured by South Dakota Concrete Products ~~or equal~~.

E. Installation:

1. Trenching shall comply with the requirements of Section 11, Utility Excavation and Backfill.
2. Minimum Cover depth from top of pipe to finished grade shall be as follows:

Size of Pipe (In.)	Minimum Cover (Ft.)
12 or less	6
14 to 18	5 ½
20 or larger	5

In the event adequate cover cannot be achieved by alignment or grade adjustment then, with prior approval of the Engineer ~~if approved by the Engineer~~, the water pipe may be insulated. Refer to the Insulation Standard Detail in cases where minimum cover cannot be provided. Insulation may also be required if adequate separation between a storm sewer or culvert and the water pipe cannot be achieved.

3. Cleaning shall be done as necessary so that the interior of all water pipe and fittings is free from all dirt, cement, or other foreign material before installation. Contact surfaces shall be wire brushed immediately prior to jointing.

4. Pipe Cutting shall be done without damage to the pipe with saw or abrasive wheel and shall be smooth, straight, and at right angles to the pipe axis. Ends of pipe shall be dressed and beveled to remove roughness and sharp corners.
5. Laying and Joining of PVC pipe shall be in accordance with AWWA C-900, AWWA C905, and AWWA C605, and with the pipe manufacturer's instructions. Laying and joining of ductile iron pipe shall be in accordance with AWWA C-600, Installation of Ductile-Iron Water Mains and their Appurtenances, and with the pipe manufacturer's instructions, unless specifically required otherwise by these Specifications. All Ductile Iron Water Mains shall be constructed with a Polyethylene Encasement tube as specified herein. The polyethylene encasement tube shall be secured circumferentially at 2 feet horizontal intervals with tape during installation.

Pipe shall be laid with bell ends facing in the direction of laying. Each pipe length shall be inspected for defects prior to being lowered into the trench. All pipe and fittings shall be carefully lowered into the trench piece by piece by means of pipe slings to prevent damage to the pipe and/or coating. Full lengths of pipe shall be installed except where connecting to appurtenances and fittings. The Contractor shall leave an appurtenance or fitting with a full length of pipe when ever possible.

Water main pipe shall not be installed in frozen ground or in water, and no water shall be allowed to run into or through the pipe.

During the course of construction, a suitable stopper shall be kept in the end of the pipe so as to prevent any dirt and or water from entering during the progress of the work at all times. Any dirt, loose material or cement mortar, which may accumulate in the pipe, shall be removed as the work progresses.

- a. Push-on Joints: The spigot end of field cut piping shall be cut square and then beveled. Joint surfaces shall be cleaned and lubricated immediately before completing the joint.
- b. Certa-Lok C900/RJ Coupling: Certa-Lok C900/RJ grooved end pipe shall be inserted into Certa-Lok C900/RJ couplings only. For use with PVC intergralintegral bells, pushonpush on fittings, or mechanical joint bells the pipe end shall be cut off at the groove and the pipe end beveled. Only insert plain end pipe into Certa-Lok C900/RJ couplings outside of the restrained "L" length for the pipe system or utilize thrust blocking or other approved joint restraint devices.
- cb. Mechanical Joints: Joints shall not be over-tightened; if an effective seal is not obtained the joint shall be disassembled, cleaned thoroughly and reassembled. Where joint restraint devices are used with a mechanical joint, the holes shall be carefully aligned to permit installation of harness bolts. At

mechanical joints, a beveled PVC spigot may not be used. Rather a non-beveled spigot shall be used for insertion into mechanical joint.

6. Protection of the Work: Once in place, the pipe shall have its open end plugged to prevent soil, water, or other matter from entering the pipe.
7. Pipe Deflection: Deflection or bending of the pipe or deflection of the pipe joint (bell and spigot) shall not be permitted except as approved by the Engineer. Changes in horizontal and vertical direction shall be achieved using standard fittings, fabricated fittings, Couplings, and/or high deflection pipe couplings specifically designed and approved for use in joint deflection.

The Engineer may approve deflection of 12 inch diameter or smaller the pipe or pipe joints if the "Engineer of Record" specifically designed for the deflection and the deflection is approved in writing by the pipe manufacturer specifically for the project. A condition of approval is the City of Rapid City receiving a letter from the pipe manufacturer stating they have reviewed the proposed pipe or pipe joint deflections for (state the project name and City tracking number) and they approve and warranty the pipe for the proposed deflections. Deflection of pipe or pipe joints for diameters greater than 12 inch is strictly prohibited.

————Certa-Lok C900/RJ pipe and couplings maybe deflected in accordance with the manufacture's written recommendationsrecommendations. The "Engineer of Record" shall specifically indicate the use of Certa-Lok C900/RJ pipe and indicate the designed deflections on the drawings.

8. Fittings: Bends and tees shall be placed on a stable foundation, which may require the use of concrete pads of equal size or larger than specified for valves. Fittings shall be provided with thrust blocks, joint restraining devices, and polyethylene encasement (where fittingswhere fittings which are not epoxy coated) as specified herein.
9. Couplings: Couplings shall be placed on a stable foundation and shall be wrapped in polyethylene encasement as specified herein. Couplings shall be approved by the pipe manufacturer for the use with the pipe and shall be installed according to the coupling manufacturer's recommendations.
10. Thrust BlocksRestraint: ~~Thrust restraints in the form of c~~Concrete thrust blocks shall be provided at tees, crosses, horizontal bends, plugs, caps, valves, fire hydrants, and similar locations whether specifically indicated on the Drawings or not. Refer to the subSection regarding "Joint Restraining Device Installations" for situations and fittings that require the use of joint restraints in-lieu of concrete thrust blocks.

Concrete thrust blocks shall have a thickness at the fitting equal to at least half the diameter of the pipe being installed but shall not be less than six (6) inches thick under any circumstances. They shall extend from the fitting to the undisturbed wall of the excavation. The Contractor shall insure that the concrete

does not cover or render inoperable nuts or bolts on the fittings. All metal fittings, valves, or appurtenances shall be wrapped in polyethylene prior to pouring thrust blocks.

Concrete Thrust blocks shall be allowed to cure for 48 hours prior to activating the water main. If the water main needs to be activated prior to the concrete curing (48 hours) then the water main shall be restrained using joint restraining devices. Prior to backfilling, thrust blocks shall cure for a minimum of four hours.

Thrust Blocks shall be installed as shown on the drawings and shall meet or exceed the minimum volume or bearing area requirements as specified on the drawings or specifications for the water pressures and soil conditions.

In muck, peat, or similar weak soils, thrust loads shall be resisted by using joint restraining devices or by removal of the soil and replacement with a material of sufficient stability to resist thrust loads as determined by the Engineer.

The use of Thrust Blocks, as specified above, is required when using Certa-Lok C900/RJ pipe and couplings.

Where prior approval of the Engineer is obtained, the Contractor may be able to substitute acceptable joint restraining devices for concrete thrust blocking. A condition of approval will be to address the potential corrosion issues associated with the use of joint restraints. The approval to substitute joint restraints is the Engineers decision and approval may or may not necessarily be granted even if the potential corrosion issues are addressed.

11. Joint Restraining Device Installations: Joint Restraining Devices are required for the following installations: Refer to Section 8.1 for the definition of "L" length for Joint restraining devices.
- a. All Valves 12 inches and larger and pipe joints within their corresponding "L" lengths shall be restrained,
 - b. All High Pressure Valves (working pressures greater than 110 psi) and pipe joints within their corresponding "L" lengths shall be restrained,
 - c. Valves 10 in. and smaller placed on dead-end mains with less than 71 feet of pipe downstream of the valve shall be restrained using the appropriate "joint restraining devices" for a dead end. Both the upstream and downstream pipe joints within their corresponding "L" lengths shall be restrained.
 - d. All Reducers/Increasers and their corresponding "L" lengths shall be restrained,
 - e. All Vertical Bends and pipe joints within their corresponding "L" lengths shall be restrained, and

- f. All Water Main Lowering and pipe joints shall be restrained.. Water Main Lowering restraint shall include restraining all joints within the fitting's corresponding "L" length plus restraining all pipe joints which lie between the start of the lowering and the end of the lowering, regardless whether or not the pipe joint is located within the fitting's "L" length.

All Joint Restraint Devices shall be double poly wrapped and taped per City Specifications for polyethylene encasement. If cathodic protection anodes are used, double poly wrap shall not be required. The polyethylene encasement ends shall be taped around the entire pipe diameter.

Joint Restraining Devices shall be installed per the manufactures' recommendations and for the appropriate water pressures and soil conditions as shown on the drawings or specifications.

12. Tracer Wire: Tracer wire shall be installed along with all water pipes as described below:

The tracer wire shall be extended along with the water main. The wire shall be installed along the top of the pipe and shall be securely anchored to the pipe every 4 feet horizontally with an adhesive tape. The tracer wire shall be extended along all water main branches and hydrant leads as well. At fire hydrant leads two (2) tracer wires (the upstream tracer wire and the downstream tracer wire) shall be brought along the lead and brought to the surface at the fire hydrant. The upstream and downstream tracer wire at fire hydrants shall not be tied together as this is intended to allow independent tracing of the downstream and upstream main.

Tracer wire shall not be installed with copper water service lines.

Tracer wire shall be installed with PVC water services. Tracer wire installed with PVC service lines shall be installed in accordance with water main requirements except that the tracer wire shall be brought to the surface at a service line valve location. Do not connect the water service tracer wire to the tracer wire on the main. Tracer wire installed along service lines shall be independent of the tracer wire installed along the main. This allows for only tracing the service line. Each service line tracer wire installation shall have its' own "Tracer Wire Access Box" installed at a service line valve location.

At locations where the PVC water service is not being replaced entirely, the contractor shall splice the new tracer wire to the existing tracer wire at the point of reconnection. In instances where a PVC water service is not being replaced entirely and an existing tracer wire is not encountered, the Contractor shall coil approximately five (5) feet of wire at the reconnection location(s) to facilitate a future splice.

A Tracer Wire Access Box shall be installed at Fire Hydrants in all cases and when specified on the drawings at valve boxes or other locations. The Tracer

Wire Access Box shall be centered 6 inches to 12 inches behind the fire hydrant. Both the upstream and downstream tracer wires shall be installed in the Tracer Wire Access Box. The tracer wires shall be taped to the Fire hydrant Barrel in at least five locations below the ground surface. The tracer wire shall be extended at least three (3) feet above the top of the Access Box, the wires connected to the Access Box lid, the wires folded, and inserted back into the Access Box for storage. The wire shall be easily retrievable for connection to and subsequent tracing.

All tracer wire connections shall be accomplished through the use of "pig-tails". All splices and "pig-tails" shall be accomplished by stripping the wires to be connected, twisting the wires together, securing the connection by using an appropriately sized wire nut, and then preserving the splice or "pig-tail" by using a direct bury splice kit.

The main line tracer wire shall run continuous along the main(s) from fire hydrant to fire hydrant but shall not be continuous at fire hydrants. At fire hydrants two tracer wires shall be installed, one wire is the main line wire from downstream of the fire hydrant and the second wire is the main line wire going upstream of the fire hydrant. The main line tracer wire shall not be interconnected at the fire hydrant or at the main. This is intended to allow independent tracing of the downstream main from the upstream main and vice a versa. Service line tracer wire shall not be connected to the main line tracer wire.

As a condition of project acceptance, Utility Maintenance Group personnel shall be able to successfully electronically trace all newly installed tracer wire/water mains. Utility maintenance personnel should be able to connect to tracing wires at every Fire Hydrant location and energize all water mains between that fire hydrant and the surrounding fire hydrants. The contractor is responsible for coordinating conductivity testing with Utility Maintenance personnel prior to finish surfacing activities. If the tracer wire does not function as intended, the contractor shall repair the system to the satisfaction of the Engineer.

The Engineer shall inspect all underground splices and "pig tails" prior to backfilling.

~~13.~~ Insulation: Insulation shall be placed where noted on the plans. Insulation board shall be placed on a smooth and level cushion, minimum of 2 inches, of fine concrete aggregate (sand) and shall be covered with a minimum of 2 inches of the same material before placing bedding or backfill material on the insulation. The build-up of insulation sheeting shall be done by staggering the joints. An acceptable adhesive may be used to retain the individual sheets in the final specified dimensions. [The Engineer of Record or Contractor shall request to use insulation and obtain approval for use from the Engineer.](#)

14. Fire Hydrants and Auxiliary Valves: Fire Hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the street, with the pumper nozzle facing the street. At intersections, the pumper nozzle shall face the higher

classification street. Hydrants shall be set with the bottom of the breaker flange 2 inches above the finished ground elevation as shown on the Standard Details, resulting in the centerline of the lowest nozzle being at least 18 inches above finished grade. In no case shall hydrants be set closer than 4 feet from curb or edge of pavement, measured from outside of hydrant barrel to back of curb or edge of pavement. In cases where a fire hydrant needs to be rotated or an extension needs to be installed, City Utility maintenance staff shall perform the work.

The Contractor shall set each fire hydrant on a 8 inch x 12 inch precast concrete pad with a 4 inch thickness and shall place a minimum of 1/3 cubic yard of Type 2 Foundation Material around the lower part of the hydrant to at least six (6) in. above the drain port to provide a drainage area for the hydrant barrel. The Contractor shall insure that the drain port at the base of the hydrant is open to allow for the hydrant to drain properly when closed. Cast in place concrete may be used in lieu of the pre-cast pad if the hydrant lead is not charged for at least 48 hours and the drainage ports are maintained.

The hydrant barrel shall be poly wrapped to the ground surface and the poly wrap shall not cover up the weep holes.

An appropriately sized thrust block shall be installed between the hydrant valve chamber and the undisturbed trench wall. The thrust block shall meet the thrust block specifications herein.

An auxiliary valve matching the size of the fire hydrant lead and a valve box shall be installed on the fire hydrant lead. Auxiliary valves shall be installed as detailed on the standard plate and shall be placed on a precast concrete block, or shall be fitted with a joint restraining device as approved by the Engineer. Cast in place concrete may be used in lieu of the pre-cast pad if the hydrant and hydrant lead are not charged for 48 hours, and 4 hours cure time is allowed before backfilling. If the auxiliary valve needs to be moved away from, the fire hydrant to avoid a conflict it may be moved up to five (5) feet away from the hydrant.

Tracer wire conduit shall be attached to the fire hydrant barrel section prior to backfill. The Tracer Wire Access Box may be installed after initial backfill. Refer to the previous section for tracer wire installation requirements.

Refer to Section 8.2 "Materials" for further information regarding the use of hydrant extensions.

Fire hydrant lead shall mean that portion of the hydrant branch line from the main to the auxiliary valve.

15. Valves: Valve interiors and adjacent piping shall be cleaned of foreign material prior to making valve to pipe connection. Pipe/valve joints shall be straight and without deflection. All valves shall be encased in polyethylene per AWWA

Standard C105 and as specified herein and shall be placed on a precast concrete anchor block and centered on the valve. Valves shall be backfilled with Type 1 bedding material to one (1) foot above the valve. The Contractor shall check all operating mechanisms for proper functioning; valves, which do not operate easily or are otherwise defective shall be replaced at the Contractor's expense.

Valves placed on dead-ends of mains with less than the required "L" length of pipe extending beyond the valve shall be restrained using the appropriate "joint restraining devices".

All Valves, which are not epoxy coated, shall be poly wrapped.

16. Valve Boxes: Valve boxes shall be installed straight and plumb directly over the valve stem and shall not be placed in direct contact with the valve. The top of the valve box shall be placed flush to ¼ inches below flush with the surfacing in paved or graveled areas and 1 inch - 2 inches above finished grade in grass surfaced areas. Where the Drawings indicate that the future grade at the valve location will be higher or lower than the existing grade at the time of valve installation, the Contractor shall provide the correct combination of extension pieces so that the valve box can be adjusted to the future finished grade without replacing the valve box.

A Valve Box Adaptor shall be installed on the valve bonnet prior to installing the valve box.

When shown on the drawings or specified, tracer wire shall be secured to the valve box section prior to backfill and a Tracer Wire Access Box" installed.

17. Tapping Tees for taps 4 inches and larger: Where new 4 inch or larger service lines or mains are to be connected to a main, the Contractor shall furnish all material necessary for connection to the water main, as specified herein. The tapping tee shall be assembled in accordance with the manufacturer's instructions. Tapping sleeves shall be supported independently from the pipe prior to tapping and shall be provided with thrust restraint as specified for other fittings. All tapping tees, which are not epoxy coated or non-corrosive material, shall be poly wrapped.

City Utility maintenance will perform all taps and the Contractor shall schedule all 4 inch and larger taps between 7:30 AM and 12:30 PM, Monday through Thursday, or as alternately scheduled by the City Utility Maintenance Department.

The Contractor shall obtain and pay for all applicable permits and tapping fees. If a tap is for a 4 inch or larger service line reconnection, then the new account set-up fee will be waived.

18. Polyethylene Fitting Encasement: All buried metallic items including fittings, valves, valve boxes, fire hydrants, pipe and accessories, ~~which are not epoxy coated or made of non-corrosive material~~, shall be encased in 8-mil thickness sheet polyethylene per AWWA Standard C105. The polyethylene sheet shall be installed per AWWA C105 and taped. The polyethylene shall fully encase the fitting and appurtenances. Excess material shall be neatly trimmed away and all seams shall be taped. The transition between the polyethylene sheet and PVC pipe or the DI poly tube shall be accomplished by, sealing the ends of the sheet and taping the material fully around the circumference of the pipe. Cost of the encasement shall be incidental to the bid price of the fitting.

An exception to the polyethylene encasement requirement is when an anode cathodically protects the metallic item. In the case where the metallic item is protected by the use of an anode then the metallic item shall not be wrapped with polyethylene encasement.

19. Dewatering: Shall be accomplished per Section 11 Utility Excavation and Backfill.

F. Disinfection:

1. General:

Disinfection shall comply with the requirements of AWWA Standard C651, C605, and C600. All new water mains and appurtenances shall be disinfected before they are placed in service. All water mains taken out of service for inspecting, repairing, or other activity that might lead to contamination shall be disinfected before they are returned to service.

2. Preventative Methods:

The tablet method specified below may be used only if the pipes and appurtenances are kept clean and dry during construction. Therefore, the Contractor shall take precautions to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material.

-If dirt enters the pipe, it shall be removed and the interior of the pipe surface swabbed with a 1%-5% hypochlorite disinfecting solution. If, in the opinion of the Engineer, the dirt remaining in the pipe will not be removed by flushing, the Contractor shall clean the interior of the pipe by mechanical means, such as a hydraulically propelled foam pig. Following mechanical cleaning the Contractor shall flush the line achieving minimum flushing velocities of at least 30 ft/s and shall then disinfect the pipe using either the continuous-feed or the slug method. Flushing a completed main will not be allowed as a method of cleaning sediment allowed to enter the pipe during construction.

All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work or for other reasons, such as rest breaks or meal periods. If water accumulates in the trench, the plugs shall remain in place until the trench is dry. If, for any reason, the water main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to floodwater shall then be filled with a chlorinated potable water that, at the end of a 24-hour holding period, will have a free chlorine residual of not less than 25 mg/l. The chlorinated water shall then be flushed from the main and after construction is completed, the main shall be disinfected using the continuous-feed or slug method.

3. Disinfectant:

Unless specified otherwise in the Detailed Specifications or on the Drawings, or required by other provisions of this specification, disinfection shall be accomplished by the tablet method. The Contractor shall obtain the Engineer's approval prior to using a method other than the tablet method.

This method requires that the pipes and appurtenances be kept clean and dry. This method may not be used if the pipes and appurtenances are not kept clean and dry and in the event this happens, the Engineer must be contacted.

Tablets shall be 5-gram calcium hypochlorite tablets conforming to AWWA Standard B300 and shall contain between 65 and 70 per cent available chlorine. Tablets shall be fresh and shall be stored in a cool, dry, and dark environment to prevent loss of strength, which occurs upon exposure to the atmosphere.

Do not use calcium hypochlorite intended for swimming pool disinfection, as this material has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time has been achieved.

4. Dosage:

Unless otherwise specified, the Contractor shall place hypochlorite tablets in each section of water pipe installed, including the hydrant branch, according to Table 8-1, below.

Table 8-1
NUMBER OF 5-GRAM CALCIUM HYPOCHLORITE
TABLETS REQUIRED

(50 mg/l Dose)

Length of Pipe Section (Ft.)	Diameter of Pipe (In.)						
	4	6	8	10	12	14	16
13 or less	1	2	2	3	5	6	8
13 - 18	1	2	3	5	6	8	11
18 - 20	1	2	3	5	7	9	12
20 - 30	2	3	5	7	10	14	18
30 - 40	2	4	6	9	14	18	24

For Pipes 18 inches and larger refer to drawings or detailed specifications for disinfection requirements. The Engineer of Record is responsible for establishing the disinfection requirements for pipes 19 inches and larger.

5. Placing Tablets:

Tablets shall be adhered to the inside top section of each pipe length using a food-grade adhesive, such as Permatex Form-A-Gasket No. 2 or Permatex Clear RTV Silicon Adhesive Sealant as manufactured by Loctite Corporation. [Adhesives shall meet the requirements of a food-grade adhesive per either NSF/ANSI 51-2005: Food Equipment Materials or NSF/ANSI 61-2005: Drinking Water System Components – Health Effects.](#) [NSF/ANSI 61](#) lists several adhesives that are approved for drinking water contact. It is recommended to use an adhesive that sets quickly and isn't reactive with the water main's composition or with the disinfectant tablet. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the pipe section to indicate the pipe has been installed with the tablets at the top.

6. Filling and Contact:

The water main shall be filled slowly so that the water velocity is no greater than one foot per second. Precautions shall be taken to assure that air pockets are eliminated. The water shall be allowed to stand in the pipe for at least 24 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service. The chlorinated water shall remain in the pipe for at least 24 hours. The Contractor shall notify the Engineer at the end of the 24-hour retention period prior to flushing to allow the Engineer to check the chlorine residual in the pipe. If the chlorine residual is less than 25

mg/l, the Contractor shall, at his expense, disinfect the water main again by the continuous-feed method or the slug method, as approved by the Engineer.

7. Flushing:

Within 48 hours of the end of the 24-hour retention period, the Contractor shall flush the heavily-chlorinated water from the main until the chlorine concentration in the water leaving the main is no higher than that prevailing in the system or is less than 1 ppm as determined by the Engineer. In addition to the above requirements, a minimum flushing velocity of 3 feet per second and flushing duration of one minute per 100 feet of pipe being flushed shall be achieved per Table 8.2.

Flushing shall be done in accordance with AWWA C651. Flushing shall be accomplished through use of hydrants or temporary fittings installed for the purpose; flushing through corporations and/or water service lines is prohibited. The Contractor shall obtain the Engineer's approval prior to installing special fittings for flushing.

Flushing shall be conducted in such a way as to prevent contamination of existing water mains and/or water service lines and to minimize traffic and pedestrian hazards and nuisance conditions. When possible, flushing shall be to the nearest storm sewer or drainage way. Flushing to the sanitary sewer is prohibited.

The Contractor will be responsible for any damage to fish and/or aquatic life caused by the chlorine residual. If Chlorine reaches or is detected in a stream, river, or other waterway the Contractor will be in violation for that discharge. For more information, contact SD DENR Surface Water Quality Program at (605) 773-3351. Refer to section below, "Disposal of Chlorinated Water" for additional information regarding neutralizing chlorine residual.

A velocity in the main of at least 3.0 fps shall be attained during flushing. The flushing shall proceed until the chlorine concentration in the water leaving the main is no higher than that prevailing in the system or is less than 1 ppm as determined by the Engineer. In no case shall the flushing duration be less than that indicated in Table 8.2.

Table 8-2

REQUIRED FLOW AND MINIMUM FLOW DURATION TO FLUSH PIPELINES

Pipe Diameter	Flow required to produce 3.0 fps Velocity in Main*	Fire Hydrants		Minimum Flushing Duration (minutes per 100 feet of pipe)
		Number of Fire	Outlet Size (In.)	
(In.)	gpm			

Hydrants				
4	120	1	2-1/2	1
6	280	1	2-1/2	1
8	480	1	2-1/2	1
10	740	1	2-1/2	1
12	1100	2	2-1/2	1**
14	1450	2	2-1/2	1**
16	1950	3	2-1/2	1**

Table 8-2 shows the rates of flow required to produce a velocity of 3.0 fps in pipes of various sizes and the minimum flushing duration per 100 feet of pipe length

For pipes 18 inches and larger refer to drawings or detailed specifications for flushing requirements.

* Requires a minimum 40-psi pressure in the main and the hydrant flowing to atmosphere.

** Assumes that the corresponding flow rate is being met.

Per AWWA C651, the Contractor shall sample for coliform bacteria contamination. After the water lines have been flushed, the contractor shall sample the lines. Two consecutive samples of water from the end of the disinfected/flushed line must be collected at least 24 hours apart. These samples must be submitted to the State Health Laboratory in Pierre, or other laboratory acceptable to the SD DENR and the Engineer. The samples must show the absence of coliform bacteria contamination before any taps may be made to the main or the main is activated and placed into service. Copies of all sample results shall be submitted to the Engineer within 48 hours of receipt thereof.

Because of the high risk of contamination during sampling, the Contractor shall use certified lab personnel or a trained sampler to collect all samples submitted for testing.

8. Disposal of Chlorinated Water:

When, in the opinion of the Engineer or Contractor, the potential exists for chlorinated water to reach a stream, river, or waterway, the Contractor shall apply a neutralizing chemical to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water as listed in Appendix B of AWWA Standard C651. The Contractor will be responsible for any damage to fish and/or aquatic life caused by the chlorine residual. If Chlorine reaches or is detected in a stream, river, or other waterway the Contractor will be in violation for that discharge. For more information, contact SD DENR Surface Water Quality Program at (605) 773-3351.

G. Pressure and Leakage Test for Mains and service lines 4 inches or larger:

1. General:

Pressure and leakage tests shall be performed on all newly installed water mains. The "Simultaneous Pressure and Leakage Tests" will be used unless otherwise specified. The testing methods specified in this section are specific for water pressure testing only; air pressure testing is prohibited due to the catastrophic nature of failure should failure occur.

Refer to Section 8.3.D "Water Main and Sewer Main/Storm Sewer Separation" for air testing requirements for Sewers when a Sewer test is required because of horizontal separation requirements.

2. Test Restrictions:

The pressure shall be 150% of the working pressure at the point of test, but not less than 125% of normal working pressure at the highest elevation, whichever is greater. Test pressure shall not exceed pipe, valve, or thrust-restraint design pressures and shall not vary by more than 5 psi (plus or minus) for the duration of the test. The duration of the hydrostatic test shall be a minimum of two (2) hours.

The Contractor shall anticipate the need to conduct multiple tests in areas of varying topography and shall conduct testing in such a manner and sequence that the pressure requirements indicated above are achieved.

3. Pressurization:

Before applying the specified test pressure, each valved section of pipe to be tested shall be slowly filled with potable water and all air expelled from the pipe, valves, fittings, and hydrants. Where City water is not available, the Contractor shall furnish sufficient potable water to fill and test the pipe. The specified test pressure, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge, shall then be applied by means of a suitable pump connected to the pipe in a manner satisfactory to the Engineer and shall be sustained for the specified time.

The test pump shall be equipped with two (2) accurate pressure gauges, between the pump shut-off valve and water main being tested, both to show the line pressure reading during testing. When hydrants are in the test section, the test shall be made against closed hydrant valves. **Pressure gauges shall have graduation marks, at minimum, for every 2 psi and be capable of interpreting pressure readings within 1 psi. The pressure reading deviation between the two pressure gauges shall not be greater than 2.0 psi. During the pressure test the pressure loss indicated between the two gauges shall not deviate more than 0.5 psi between the two gauges.**

4. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within five (5) psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by the drop in pressure for a test section over a period of time.
5. Allowable Leakage for PVC Pipe and Ductile Iron Pipe:

The PVC pipe shall be pressure and leakage tested in accordance with AWWA C605. The Ductile Iron pipe shall be pressure and leakage tested in accordance with AWWA C600.

No pipe installation, PVC pipe or ductile iron pipe will be accepted if the leakage is greater than that indicated in Table 8-3.

Table 8-3

**ALLOWABLE LEAKAGE IN GALLONS
PER HOUR PER 1000 FT OF PIPE
(GPH)**

Pipe. Dia. (in.)	Average Test Pressure (PSI)					
	50 psi (gph)	100 psi (gph)	150 psi (gph)	200 psi (gph)	250 psi (gph)	300 psi (gph)
4	0.19	0.27	0.33	0.38	0.43	0.47
6	0.29	0.41	0.50	0.57	0.64	0.70
8	0.38	0.54	0.66	0.76	0.85	0.94
10	0.48	0.68	0.83	0.96	1.07	1.17
12	0.57	0.81	0.99	1.15	1.28	1.40
14	0.67	0.95	1.16	1.34	1.50	1.64
16	0.76	1.08	1.32	1.53	1.71	1.87
18	0.86	1.22	1.49	1.72	1.92	2.11
20	0.96	1.35	1.66	1.91	2.14	2.34
24	1.15	1.62	1.99	2.29	2.56	2.81
30	1.43	2.03	2.48	2.87	3.21	3.51
36	1.72	2.43	2.98	3.44	3.85	4.21

6. Acceptance shall be determined on the basis of allowable leakage. If any test of installed pipe discloses leakage greater than that specified in Table 8-3, the Contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance. All visible leaks shall be repaired, regardless of the amount of leakage.

Any damaged or defective pipe, fittings, valves, hydrants, or joints discovered following the pressure test shall be repaired or replaced with approved material

at the Contractor's expense, and the test shall be repeated until it is within the specified allowance.

7. Example - A pipe segment is required to be tested at 140 psi. At the start of the test, pressure gauge #1 indicates an initial pressure of 141 psi and pressure gauge #2 indicates an initial pressure of 143 psi. Both gauges are recording the test pressure within 2 psi and therefore the test may proceed. After completing the two-hour test duration, pressure gauge #1 indicates a pressure of 134 psi and pressure gauge #2 indicates a pressure of 136.5 psi. The pressure drop for pressure gauge #1 is 7 psi and the drop for pressure gauge #2 is 6.5 psi. The two gauges record a pressure drop within 0.5 psi of each other therefore the deviation of the pressure reading between the two gauges is acceptable.

If the pressure test had indicated a pressure loss of less than 5 psi then the "Pressure and Leakage Test" would have been considered as passing. Because in this example, the pressure loss is more than 5 psi, the Contractor may elect to re-pressurize the system and repeat the two-hour test or the Contractor may elect to measure the quantity of water required to pressurize the pipe segment so that the pressure loss is less than 5 psi. For this example if the quantity of water required to pressurize the pipe segment so that pressure gauge #1 indicates a pressure of 137 psi (loss of 4 psi) and pressure gauge #2 indicates a pressure of 137.5 psi (loss of 4.5 psi), is within the quantity of water allowed per Table 8-3 then the test would be considered as passing without having to repeat pressure test for two-hours.

H. Pressure and Leakage Test for Service Lines less than 4 inches:

Pressure and leakage tests shall be performed on all newly installed copper water service lines if the service line has one or more couplings installed between the corporation and the curb stop and/or one or more couplings installed between the curb stop and the Property Water Distributing System. The testing method shall be as specified in the National Standard Plumbing Code with the exception that air pressure testing is prohibited.

I. Water Main Closures and Temporary Service:

1. Water Main Closures shall be scheduled to minimize the inconvenience to the public. Consequently, water main closures shall be scheduled, between 8:00 A.M. and 4:00 P.M. Monday through Thursday, when possible. Short duration closures (closures scheduled to last no longer than two hours) may be scheduled on Friday between the hours of 8:00 AM and 11:30 AM.. Water main closures scheduled to begin prior to or continue beyond those times listed above, will require approval from the Engineer. In any case, water main closures will not be allowed until the Engineer gives his approval.

The Contractor shall obtain notification of closure cards from the Engineer and shall hand-deliver the closure cards to affected properties at least 48 hours prior to closure of any water main, unless a shorter time of notice is approved by the Engineer.

2. Operation of Valves: Only City personnel shall operate valves on existing water mains. The Contractor may operate valves on newly installed water mains that are under his control, until such time as, they are accepted by the City for operation and maintenance.
3. Temporary water service for private residences affected shall be provided by the Contractor when the water main closure will exceed eight (8) hours. The Contractor shall provide temporary water service for businesses upon request, regardless of the length of closure. When temporary service is to be provided to businesses, the Contractor shall obtain the name and phone number of a responsible contact person at each affected business and submit the information to the Engineer at least 48 hours prior to closure.

J. Abandonment and/or Salvage of Water Main and Appurtenances:

1. Water Mains:

The Contractor shall seal all open ends of water mains to be abandoned with a concrete plug having a length equal to the diameter of the pipe being plugged.

2. Fire Hydrants:

Fire hydrants and auxiliary valves are to be removed and salvaged, unless indicated otherwise on the drawings or Detailed Specifications, and shall be delivered by the Contractor to the City Utility Maintenance Shop on Steele Avenue in good working condition. Any damage to the hydrant and/or appurtenances as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.

3. Valves:

Unless indicated otherwise on the drawings or Detailed Specifications, valves are to be removed, salvaged, and delivered by the Contractor to the City Utility Maintenance Shop on Steele Avenue in good working condition. Any damage to the valve as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.

4. Valve Boxes:

The Contractor shall close the valve, remove and salvage the top sections of those water main valve boxes marked on the plans to be abandoned and shall deliver them to the City Utility Maintenance Shop on Steele Avenue. The resulting holes shall be backfilled and compacted to meet the requirements of these specifications and shall be resurfaced with the appropriate material; i.e. seed, sod, asphalt, concrete, etc.

5. Others:

When the drawings indicate items are to be removed or salvaged, the Contractor shall deliver the items to the City Utility Maintenance Shop on Steel Avenue in good working condition. Any damage to the items as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.

Unless an item is indicated as salvaged, the item will be considered a Contractor obligation to remove and dispose of.

K. Service Lines and Fittings:

1. Permits, obtainable from the City Utility Maintenance Division, will be required for all connections to the Rapid City water system.
2. Service pipe: Copper pipe shall be laid with sufficient waving as to prevent rupture in settlement. A "goose-neck" shape shall be constructed in the copper pipe leading from the corporation stop. Copper splicing couplings shall be as described in this specification. PVC and ductile iron service pipe shall be laid as specified herein for water mains. Minimum cover depth for water service lines shall be six (6) feet. A ten (10) foot horizontal separation shall be maintained between water service and sewer service lines. Tracer Wire shall be installed along with all PVC service lines, as described in the specification section relating to tracer wire. Tracer Wire shall not be installed with copper service lines.
3. Service saddles shall be installed for all connections to water mains. Unless specified otherwise on the Drawings or Detailed Specifications, the Contractor shall furnish and install all service saddles.

4. Corporation stops shall be provided by the Contractor, except for 1inch corporation stops, which the City provides. The Contractor shall communicate the water main material type to Utility Maintenance at the time a tap is requested. Corporation stops that are used to connect copper water services to metallic water mains shall be the isolator style. City personnel, in all cases will tap the main and install all corporation stops. - If a Contractor is installing a copper water service on private property but is not replacing the service to the main and the copper water services connects to a metallic water main then an insulating union for copper water services shall be installed near the curb stop or at the location where the new copper connects to the existing copper. This is only required for copper water services connecting top metallic mains.
5. Service lines larger than 2 inches diameter shall be connected to the main with either an appropriately sized tapping sleeve and valve or a ductile iron tee as specified for water main fittings elsewhere in these specifications.
6. Curb stops and boxes shall be installed on all service lines and shall be located entirely within the public Right of Way. The curb stop and box shall be located between one and seven feet from the property line, unless otherwise approved by the Engineer. If any curb box is closer to the property line than 0.9 feet or farther from the property line than 7.1 feet, measured to the center of the box, then the box shall be reset to within the allowable tolerance. Curb boxes shall be installed straight and plumb directly over the curb stop. The top of the curb box shall be placed flush to ¼ inch below flush with the surfacing in paved or graveled areas and 1 - 2 inches above finished grade in grass surfaced areas. Where the Drawings indicate that the future grade at the cur box will be higher or lower than the existing grade at the time of installation, the Contractor shall provide a curb box that is applicable for the future finished grade without having to replace the curb box.

7.7. Water Service New Connections: Where new service lines are to be installed for undeveloped property or future buildings or additional services added to an existing building, the Contractor shall furnish all materials necessary for connection of new service lines to the water main, except 1inch corporation stops, as specified herein and shall obtain and pay permits and tapping fees as established by Ordinance.

Where the new service line is terminated, the service line shall be capped and plugged water tight to prevent leakage if the curb stop is inadvertently opened. New service connections shall have curb stops left turned off at the time of installation and the termination point shall be marked with a minimum three (3) foot long steel fence post. The steel post shall be buried below the surface at least eight (8) inches. The post needs to be steel to facilitate location by magnetic locators.

City personnel shall tap all city water mains, the Contractor shall schedule all service taps between 7:30 AM to 3:00 PM, Monday through Friday.

Water Service New Connections for service lines 4 inches or larger shall be made as described in the section for tapping tees.

8. Water Service Reconnections: The Contractor shall furnish all materials necessary for reconnecting service lines existing prior to reconstruction of a water main, except 1 inch corporation stops as specified herein. On City projects, all permits and tapping fees will be waived; however, the Contractor shall obtain a no-charge permit to work in the right-of-way from the City Utility Maintenance Group.

On non-City projects, the new account set-up / inspection permit (tap permit) will be waived however, the Right-to-Work permit and tapping fees are still applicable.

City personnel shall tap all city water mains, the Contractor shall schedule all service taps between 7:30 AM to 3:00 PM, Monday through Friday.

Water service reconnections for service lines 4 inches or larger shall be made as described in the section for tapping tees.

9. Inspection: All water service installations, regardless of whether or not the service is located on private property or in public ROW, shall be inspected by the City Utility Maintenance Group prior to the Contractor backfilling the trench. The Contractor shall notify the City Utility Maintenance Group a minimum of four (4) hours prior to the time he needs the inspection. Any trench backfilled without being inspected and approved by authorized City personnel shall be re-excavated by the Contractor to expose the work for the required inspection. Discrepancies shall be corrected by the Contractor and re-inspected by City personnel.

L. Acceptance of Curb Stops and Main Valves:

As a condition for project acceptance, all curb stops and water main valves within the project boundaries shall be in proper operating condition. City personnel will inspect and operate each curb stop and water main valve as part of the final inspection. The Contractor shall correct any deficiencies discovered during the inspection

8.4 METHOD OF MEASUREMENT

A. Water Main and Service Line Pipe:

Installed pipe quantities shall be determined by measuring from centerline to centerline of all pipe and fittings. Measurements shall be to the nearest whole foot.

B. Water Main Fittings and Couplings:

Fittings furnished and installed shall be counted on a per each basis. Measurement for concrete thrust blocks, cable and rods, and other thrust restraint will not be made; such work shall be incidental to the respective work item.

C. Valves:

Valves shall be counted on a per each basis. Valve boxes shall be included with the valves as a complete unit.

D. Fire Hydrant and Auxiliary Valve:

Fire hydrants will be counted on a per each basis. Auxiliary valve, valve box and pipe between the auxiliary valve and hydrant shall be included with the hydrant as a complete unit; no separate measurement and payment will be made for pipe between the auxiliary valve and the hydrant and for auxiliary valves and boxes.

E. Fire Hydrant Lead:

The water main pipe for the hydrant lead (branch) from the main to the Auxiliary Valve shall be paid for at the unit price bid for the appropriate size pipe.

F. Fire Hydrant Extensions:

Fire hydrant extension quantities shall be determined by measuring the vertical length of the extension. Measurement shall be to the nearest half foot.

G. Abandonments:

No separate measurement will be made for abandonment of water mains, valves and boxes, or salvaging hydrants, auxiliary valves and boxes; such work will be incidental to the project unless otherwise specified.

H. Water Service [New](#) Connections and Reconnections:

Water service reconnections and new water service connections will be counted on a per each basis.

The pipe used for reconnections and connections shall be measured and paid for under the bid item for water service pipe.

I. Service Saddles:

Service saddles furnished and installed will be counted on a per each basis.

J. Service Corporation Stops:

Service corporation stops furnished by the Contractor will be counted on a per each basis. No measurement will be made for service corporation stops furnished by the City.

K. Curb Stops and Boxes Installed, Adjusted or Abandoned:

Curb stops and boxes furnished and installed, adjusted, or abandoned will be counted on a per each basis.

L. Water Main Insulation:

Measurement for water main insulation will be made on a square foot basis to the nearest square foot.

M. Water Main Encasement:

Measurement for water main encasement will be made on a per each basis, furnished and installed, for each encased crossing with lengths as noted on the Drawings.

N. Thrust Blocks and Joint Restraints:

No separate measurement will be made for thrust blocks or joint restraint devices, such work will be incidental to the pipe.

O. Polyethylene Encasement:

No separate measurement will be made for polyethylene encasement such work will be incidental to the pipe and fittings.

P. Water meter pits:

Water pits furnished and installed will be counted on a per each basis.

Q. Tapping Tee (Includes sleeve and valve):

Tapping tees furnished and installed will be counted on a per each basis.

R. Tracer Wire, tracer wire access boxes, and all accessory items necessary for the installation of tracer wire shall be considered as incidental to the pipe installed.

S. Water Main Lowering:

Water main lowerings including, all materials, restraints, and low strength concrete for the complete installation shall be included in the bid item for water main lowering. Water main lowerings shall be counted on a per each basis.

T. Abandon valve:

Abandon valve shall be counted on a per each basis.

U. Adjust Valve Box:

Adjust valve box shall be counted on a per each basis.

V. New Water Main Connections:

New water main connections shall be counted on a per each basis. The bid item, New Water Main Connections, is intended for use where a tapping tee cannot be used and where an in-line tee must be cut into an existing main or where a cap/plug with thrust block must be removed prior to connecting.

8.5 BASIS OF PAYMENT

A. Water Main Pipe:

Payment will be at the unit price bid for the appropriate size of water pipe, furnished and installed, including trenching, excavation, Type 1 bedding material, compacting, backfilling, dewatering, sheeting or shoring, pressure and leakage testing, disinfection, and, for ductile iron pipe, polyethylene encasement. Unless otherwise specified, no extra payment will be made for excavation deeper than that required to provide minimum specified cover. The cost of providing temporary water service and plugging abandoned water mains shall be incidental to the project.

B. Water Main Fittings and Couplings:

Payment will be made at the unit price bid for the appropriate fitting, furnished and installed, including polyethylene encasement, and thrust blocks and/or restraints.

C. Valves:

Payment will be made at the unit price bid for the appropriately sized valve, furnished and installed, including valve box, polyethylene encasement, concrete pad, and thrust restraint.

D. Fire Hydrant and Auxiliary Valve:

Payment will be made at the unit bid price, complete, furnished and installed, including trenching, excavation and backfilling, dewatering, sheeting or shoring, and disinfection. The bid price shall include the auxiliary valve and box.

E. Fire Hydrant Extension:

When a fire hydrant extension is necessary due to no fault of the Contractor, as specified herein, payment will be made under the bid item for the fire hydrant extension per price bid. City personnel shall install all Fire Hydrant Extensions.

However, if the hydrant could have been installed or ordered with the correct barrel length such that an extension was not necessary, the Contractor shall furnish and install a new Fire Hydrant with the correct barrel length. Hydrant Extensions in these cases will not be permitted.

F. Abandonments:

No separate measurement will be made for abandonment of water mains, valves and boxes, or salvaging hydrants, auxiliary valves and boxes; such work will be incidental to the project.

G. Water Service Lines:

Payment will be made at the unit price bid for the appropriately sized pipe, furnished and installed, including trenching, excavation and backfilling, compacting, dewatering, and sheeting or shoring. The cost for any connections between the new service line and existing service lines shall be included in the unit price bid for the appropriate sized pipe.

H. Service Saddles:

Payment will be made at the unit price bid for the appropriately sized service saddle, furnished and installed.

J. Service Corporation Stops:

Payment for Contractor furnished corporation stops will be made at the unit price bid for the appropriately sized corporation stops. No payment will be made for one inch corporation stops, which shall be furnished by the City Utility Maintenance Group. [The Utility Maintenance Group will also furnish one-inch isolator/insulated corporation ball valves when required.](#)

J. Curb Stops and Boxes:

Payment will be made at the unit price bid for the appropriately sized curb stop and box, complete, furnished and installed.

K. Water Service New Connection:

Payment will be made at the unit price bid for connecting new water services up to two (2) inches in diameter to the new water main, including fittings necessary to connect the service line to the corporation stop. The cost of connecting water service lines two (2) inches or greater shall be included in the unit price bid for the fitting required to connect the service lines to the water main. Payment for Water Service New Connection shall include Right to Work permit, New Account Setup/Inspection permit (tap permit) and tapping fees, unless otherwise specified in the Detailed Specifications.

L.. Water Service Reconnection:

Payment will be made at the unit price bid for reconnecting existing water services up to two (2) inches in diameter to the new water main, including fittings necessary to reconnect the service line to the corporation stop. The cost of reconnecting water service lines two (2) inches or greater shall be included in the unit price bid for the fitting required to connect the service lines to the water main. On City projects, all permits and tapping fees will be waived. On non-City projects the New Account Setup/Inspection permit will be waived, however the Right-to-Work permit and tapping fees are still applicable.

M. Water Main Lowering:

Payment will be made at the unit price bid for lowering water main, including appropriate size pipe restraints, fittings, low strength concrete, and incidentals necessary to complete the work. Water main lowering shall be that, which is physically lowered vertically with the horizontal location not changed more than five (5) feet from original.

N. Water Main Encasement:

Payment will be made at the bid price, furnished and installed, including materials, temporary blocking and restraint of the pipe, and incidentals necessary to complete the work.

O. Water Main Insulation:

Payment will be at the bid price for water main insulation furnished and installed, including cushion material.

P. Meter Pit:

Payment for meter pits will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials, including castings, precast or cast-in-place floors, precast manhole sections, and incidentals necessary to complete the item.

Q. Tapping Tees:

Payment for tapping tees will be at the bid price per each including sleeve and valve, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item. The Contractor shall include payment for the "right to work" Permit, (tap permit), if applicable, and tapping fees in this bid item.

R. Abandon Valve:

Payment for abandoned valve will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item.

S. Adjust Valve:

Payment for adjusted valve will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item.

T. New Water Main Connection:

Payment for new water main connection will be at the bid price per each, complete and shall be considered full compensation for all labor, tools, equipment, materials and incidentals necessary to complete the item.

U. Tracer Wire System:

Tracer wire, tracer wire access boxes, and all accessory items necessary for the installation of tracer wire shall be considered as incidental to the pipe installed.

END OF SECTION