

Special Specification 7231

Water Line Installation



1. DESCRIPTION

Water mains including valves, valve boxes, service meters, hydrants, blocking, fittings, and other appurtenances for potable water distribution systems. Steel and Iron materials must comply with 23 CFR 635.410 provisions of Buy America.

1.1. **References.** When referring to the standards listed below, it means the latest standard or tentative standard in effect on the date of the proposal.

- ANSI 16.1—Cast Iron Pipe Flanges and Flanged Fittings.
- 30 TAC 290—Texas Administrative Code, Volume 30, Chapter 290, Water Hygiene.
- UL 246—Hydrants for Fire-Protection Service.
- ASTM A53—Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
- ASTM A126—Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
- ASTM A307—Specification for Carbon Steel bolts and Studs 60,000psi Tensile.
- ASTM A536—Ductile Iron Castings
- ASTM D1784—Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds.
- ASTM D1785—Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- ASTM D2241—Polyvinyl Chloride (PVC) Plastic Pipe (SDR-PR).
- ASTM D2466—Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
- ASTM D2737—Polyethylene (PE) Plastic Tubing.
- ASTM D2855—Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
- ASTM D3139—Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
- ASTM F477—Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- AWWA C104—Cement-Mortar Lining for Ductile Iron Pipe and Fitting for Water.
- AWWA C105—Polyethylene Encasement for Ductile Iron Piping for Water and other Liquids
- AWWA C110—Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. for Water and other Liquids.
- AWWA C150—Thickness Design of Ductile Iron Pipe.
- AWWA C151—Ductile Iron Pipe.
- AWWA C153—Ductile Iron Compact Fittings, 3 in. through 12 in. for Water and other Liquids.
- AWWA C500—Metal-Seated Gate Valves for Water Systems.
- AWWA C502—Dry Barrel Fire Hydrants
- AWWA C509—Resilient-Seated Gate Valves for Water Systems.
- AWWA C550—Protective Interior Coatings for Valves and Hydrants.
- AWWA C600—Installation of Ductile-Iron Water Mains and Appurtenances.
- AWWA C700—Cold Water Meters Displacement-Type, Bronze Main Case.
- AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water.
- AWWA C901—Polyethylene (PE) Pressure Pipe, Tubing and Fittings, 1/2 in. through 3 in. for Water.
- AWWA C905—Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 in. through 36 in.
- ASTM C33—Coarse Aggregates.
- ASTM D698—Moisture-Density Relations of Soil (Standard).
- ASTM D1557—Test for Moisture-Density Relations of Soil (Modified).

- ASTM D2321—Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity – Flow Applications.
- ASTM D2487—Classification of Soils for Engineering Purposes.
- ASTM D4254—Minimum Index Density and Unit Weight of Soils and Calculations of Relative Density.
- ASTM D4318—Test for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- OSHA—Occupational Safety and Health Administration and Related Regulations.
- AWWA B300—Standard for Hypochlorite's.
- AWWA B301—Standard for Liquid Chlorine.
- AWWA C651—Standard for Disinfecting Water Mains.
- 30 TAC 290.38 through 290.49—Rules and Regulation for Public Water Systems, *Texas Administrative Code*.

1.2. **Submittals.** Submit the following documentation in accordance with the pertinent Specification Items.

- **Product Data:** Manufacturer's product data sheets on all materials incorporated into Work.
- **Certificates:** Manufacturers certificates attesting compliance with applicable Specifications for grades, types, classes, and other listed properties.
- **Project Record Documents:** Submit documentation in accordance with pertinent Specification Items. Accurate record drawings showing installed locations of manholes, cleanouts, valves, piping, service connections, and other accessories.

1.2.1. **Bedding and Backfill.** Submit samples of materials proposed to be used for bedding in the pipe zone.

- One set to materials testing lab for classification and
- One set to Engineer for approval.

1.2.2. **Water Line Disinfection & Testing**

- **Test Reports.** Indicate results comparative to specified requirements.
- consider deleting this item
- **Project Record Documents.** Submit the following required documentation in accordance with the applicable Specification sections.
 - **Disinfection Report.** Information to be recorded includes: type and form of disinfectant used, date and time of disinfectant injection start and time of completion, test locations, initial and 24-hr. disinfectant residuals (quantity in treated water) in ppm for each outlet tested, date and time of flushing start and completion, and disinfectant residual after flushing in ppm for each outlet tested.
 - **Bacteriological Report.** Information to be recorded includes: date issued, project name and testing laboratory name, address and telephone number, time and date of water sample collection, name of person collecting samples, test locations, initial and 24-hr. disinfectant residuals in ppm for each outlet tested, coliform bacteria test results for each outlet tested, certification that water conforms, or fails to conform to bacterial standards of AWWA C651, C652, and 30 TAC 290.38 through 290.46

1.3. **Delivery, Storage and Handling.** Each load of pipe delivered to the project site will be inspected by the Engineer for compliance with the Project Specifications. Pipe must be transported with ends covered to prevent debris accumulation during transport. Pipe must be kept in bundles (as shipped from the plant) until the day that it is to be installed. Deflection test may be required if deflection is apparent.

1.3.1. **Protection and Removal of Existing Utilities.** The Contractor must anticipate all underground obstructions, such as but not limited to, water mains, gas lines, storm and sanitary sewers, telephone or electric light or power ducts, concrete and debris. Any such lines or obstructions indicated on the Drawings show only the approximate locations and must be verified in the field by the Contractor. The Owner and Engineer will endeavor to familiarize the Contractor with all known utilities and obstructions, but this will not relieve the Contractor from full responsibility in anticipating all underground obstructions whether or not shown on the

Drawings. Contractor must, at his own expense, maintain in proper working order and without interruption of service all existing utilities and services which may be encountered in the work. With the consent of the Engineer and utility owner such service connections may be temporarily interrupted to permit the Contractor to remove designated lines or to make temporary changes in the locations of services. The cost of making any temporary changes will be at the Contractor's expense. Notify all utility companies involved to have their utilities located and marked in the field. All underground utilities in a particular segment of the project must then be uncovered to verify location and elevation before construction begins in that segment of the project. Any utilities found, not on drawings, must be documented and submitted with as-built drawings at project closeout.

- 1.4. **Definitions.** All excavation associated with the project is unclassified.
- **Bedding.** Includes the area from the trench bottom to the bottom of the pipe where material is placed to bring the trench bottom up to grade. A compacted depth of approximately 4 to 6 in. is generally enough bedding thickness.
 - **Haunching.** Includes the area from the bottom of the pipe to the spring line of the pipe. Material in this area must be placed and consolidated to provide adequate side support while avoiding both vertical and lateral displacement of the pipe. **The type and density of the material in this area are the most important factors affecting the performance and deflection of the pipe.**
 - **Initial Backfill.** Includes the area from the spring line of the pipe to a point at least 6 in. over the top of the pipe.
 - **Final Backfill.** Includes the area above the initial backfill, up to final grade or the bottom of the flexible base material in the pavement section.
 - **Pipe Zone.** Includes areas of bedding, haunching and initial backfill as defined above.

2. MATERIALS

Products must comply with changes to the Safe Drinking Water Act that reduce the maximum allowable lead content of pipes, pipe fittings, plumbing fittings, and fixtures to 0.25%. Polyvinyl Chloride (PVC) pipe and fittings.

- 2.1. **Pipe.** PVC water pipe must bear NSF 61 seal of approval.
- Pressure Class: AWWA C900 DR 25 (4 in. – 12 in. Diameter) – Pressure Class 150. Smaller diameter pipe to be CL200. Joints must be integral bell with flexible elastomeric seal.
- Meter service line: Polyethylene pressure pipe per AWWA C901 (ASTM D2737). SDR-9, PE2306, or PE3306. Provide stainless steel stiffeners at connections.
- 2.2. **Fittings.** Fittings must be push-on, mechanical joint, or flanged pipe as shown.
- ANSI 16.1 - Cast Iron Pipe Flanges and Flanged Fittings
- 2.3. **Couplings.** Flanged Coupling Adapters must conform to ASTM A126, Class B, Cast Iron. Dresser Style 127, Uni-flange Series 400, or engineer approved equal.
- Flexible Couplings must be gasketed, sleeve type, straight cast. Dresser Style 38 or Style 162, or engineering approved equal. Supply couplings with working pressures which meet or exceed the joining pipe rating.
- Service clamps for copper tubing sizing (CTS) polyethylene pipe service connections must be bronze, two-piece with O-Ring seal. Muller or engineer approved equal.

- 2.4. **Bolts and Gaskets.** Bolts must be 1/16-in. cloth insert, red rubber, full face. Bolts must be in accordance with Non-pressure applications (ASTM A307A), Pressure applications (ASTM A307B), and Submerged/splashed (316 stainless steel).
- 2.5. **Tapping Sleeves.** Must be certified to ANSI/NSF 61.
- Shell and lugs must be 304 Stainless steel.
- Bolts, washers, and nuts must be NC Rolled Thread, 304 Stainless Steel.
- Gaskets must be Virgin SBR compounded for water service.
- Outlet flange must be 304 Stainless Steel or Ductile Iron, ASTM 536 and meet or exceed all applicable requirements of ANSI B16.1, Class 125.
- 2.6. **Gate Valves.** Gate Valves sizes 2-in. through 8-in. must be solid wedge, resilient seat type. Mueller, M&H or approved alternate.
- Conform to AWWA C509.
- Working pressure rated to 200 psi minimum.
- Must have a non-rising stem with O-ring valve packing and 2-in. square nut, except as shown otherwise.
- Must have mechanical joints and counter-clockwise opening.
- Ferrous surfaces of valve interior epoxy coated, AWWA C550.
- Wrap valve body with 8-mil polyethylene encasement in a manner which will not interfere with valve operations, buried service.
- 2.7. **Fire Hydrants.** Must be standard dry barrel, AWWA C502, UL 246. Mueller, M&H or approved alternate.
- Extensions must be fabricated in multiples of 6-in. with rod and coupling to increase barrel length.
- Hose and Steamer Connections must match sizes with utility company/municipality, two hose nozzles, one pumper nozzle.
- Must be finished with primer and two coats of enamel, color required by utility company/municipality.
- 2.8. **Flush Valves.** 2-in. flush valves must be 2-in. gate valve and box, 2-in. galvanized steel pipe riser with 2-in. galvanized 90° bend, and 2-in. galvanized plug as noted on the Plans. A 2-in. galvanized nipple must be used between the gate valve and riser and a Schedule 80 PVC nipple with PVC coupling between the gate valve and the main line. If tied directly to the saddle or tee, a brass nipple must be used between the gate valve and saddle. The riser must be placed adjacent to the ROW line.
- 2.9. **Corporation Stops.** Waterworks iron pipe size (IPS) inlet and Compression connection for CTS PE plastic pipe with rigid liner for outlet. Mueller 110 Compression or engineer approved equal.
- 2.10. **Meter Stops.** Compression connection for CTS PE plastic pipe with rigid liner for inlet and meter saddle nut, right angle cut-off, lock wing for outlet. Mueller 110 Compression or engineer approved equal.
- 2.11. **Pipe Zone.** Materials to be placed must be in accordance with the plans. Suitable materials for use must be in accordance with following Table 2.1:

**TABLE 2.1
DESCRIPTION OF MATERIAL CLASSIFICATION
(as defined in ASTM D2321)**

| Class | Type | Soil Group Symbol | Description ASTM D2487 | % Passing Sieve Sizes | | | Atterberg Limits | | Coefficients | |
|-------|--|--------------------|--|-------------------------|-------------------------|-----------------|-------------------------------|-----------------|---------------------------|--------------------------|
| | | | | 1½ in (40 mm) | #4 (4.75 mm) | #200 (0.075 mm) | LL ^b | PI ^c | Uniformity C _u | Curvature C _c |
| I | Manufactured, Processed Aggregate; dense-graded, clean | None | Angular, granular, crushed stone or rock, crushed gravel, and stone/sand mixtures with gradations selected to minimize migration of adjacent soils; contain little or no fines | 100% | ≤50% ⁰ | <5% | Non Plastic | | | |
| II | Coarse-Grained Soils, clean | GW | Well-graded gravels and gravel-sand mixtures; little or no fines | 100% | <50% of Coarse Fraction | <5% | Non-Plastic | | >4 | 1 to 3 |
| | | GP | Poorly-graded gravels and gravel-sand mixtures; little or no fines | | | | | | <4 | <1 or >3 |
| | | SW | Well-graded sands and gravelly sands; little or no fines | | >50% of Coarse Fraction | | | | >6 | 1 to 3 |
| | | SP | Poorly-graded sands and gravelly sands; little or no fines | | <6 | | | | <1 or >3 | |
| | Coarse-Grained Soils, borderline clean to w/fines | e.g. GW-GC, SP-SM. | Sands and gravels which are borderline between clean and with fines | 100% | Varies | 5% to 12% | Same as for GW, GP, SW and SP | | | |
| III | Coarse-Grained Soils with Fines | GM | Silty gravels, gravel-sand-silt mixtures | 100% | <50% of Coarse Fraction | >12% to <50% | | | <4 or <"A" Line | |
| | | GC | Clayey gravels, gravel-sand-clay mixtures | | | | | | <7 and >"A" Line | |
| | | SM | Silty sands, sand-silt mixtures | >50% of Coarse Fraction | >4 or <"A" Line | | | | | |
| | | SC | Clayey sands, sand-clay mixtures | | >7 and >"A" Line | | | | | |

^a Includes Test Method ASTM D2487 borderline classifications and dual symbols depending on plasticity and liquid limits.

^b LL = Liquid Limit.

^c PI = Plasticity Index.

In addition to the materials included in Table 2.1, the following materials are approved for the pipe zone or within 24 in. of fiberglass structures where shown:

- Lean Concrete: Free-flowing grout, mixed one sack of cement per cubic yard of sand.
- Structural Concrete: Concrete for encasement must be 3,000 psi compressive strength as specified in Section 03300.

2.12. Final Backfill Materials

Earth Backfill. Earth backfill may be excavated and reused from trench or obtained from an approved borrow area. Material must be processed to ensure that only select material is used for backfilling operations. Material must be free of lumps, clods, large rocks, debris, trash, organic, spongy or otherwise objectionable material. The presence of such material in the backfill may preclude uniform compaction and result in excessive localized point loads on or deflections in the piping system or fiberglass structure.

All materials included in Table 2.1 above are approved for final backfill.

2.13. **Water Quality Assurance.** Perform work in accordance with AWWA C651 and C652.

2.14. **Testing Firm.** Approved laboratory by the Texas Department of State Health Services (DSHS).

Submit bacteriologist's signature and authority associated with testing.

Bacteriologist test must indicate negative. If other than negative disinfection, will be repeated at contractor's expense.

3. CONSTRUCTION

3.1. **Preparation.** Stake locations of fittings, valves (where applicable) and other accessories before installation for Engineer to review.

Before installation, remove foreign matter from within pipes, manholes, cleanouts, fittings, and valves. Verify material is in satisfactory condition and the valves and other mechanical devices function properly.

Do not lay pipe in water, or when trench or weather are unsuitable for work. Keep water out of trench until jointing is complete and bedding is placed to the top of pipe. When work is not in progress, close end of pipe and fittings securely so that no trench water, earth or other substances will enter pipes or fittings.

Keep inside of pipe free from foreign matter during operations by plugging or other approved method.

Place pipe so that full length of each section rests solidly upon pipe bedding, with recesses excavated to accommodate bells and joints. Take up and re-lay pipe when grade or joint is disturbed after placing.

Handle pipe and accessories so that pipe placed in trench is sound and undamaged. Take particular care not to injure pipe coating when applicable.

Cut pipe neatly, using approved type mechanical cutter without damaging pipe. Use when cutters when practicable.

Wrap ductile iron pipe fittings, and valves with 8 mil polyethylene film, AWWA C105, with edges overlapped and securely taped with duct tape to prevent contact between pipe and surrounding bedding. Repair punctures with duct tape to restore the protective continuous wrap before backfilling.

3.2. **Bedding and Backfill.** Accurately grade the bottom of the trench 4 in. below the bottom of the pipe and to the limits of the clear space on either side of the pipe.

Install materials which comply with Table 2.1 above and in accordance with "Embedment" detail shown on the plans.

The initial layer of embedment material placed to receive the pipe must be brought up to a grade slightly higher than that required for the bottom of the pipe and the pipe must be placed thereon and brought to grade by tamping, or by removal of the slight excess amount of embedment under the pipe.

Adjustment to grade line must be made by scraping away or filling with embedment materials. Wedging or blocking up of pipe will not be permitted.

Each pipe section must have a uniform bearing on the embedment for the full length of the pipe, except immediately at the joint.

After each pipe has been graded, aligned, placed in final position on the bedding material and joint made, enough embedment material must be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and alignment during subsequent pipe jointing and embedment operations.

Sheeting and shoring will not be allowed in the pipe zone during or after installation of the pipe or embedment material, unless special provisions are made to ensure the specified compaction of bedding and pipe alignment is maintained after removal of sheeting and shoring.

Minimum compaction effort within the pipe zone must be in accordance with the following Table 3.1 based on the class of bedding material used:

**TABLE 3.1
MINIMUM REQUIRED COMPACTION**

| Classification of Bedding Material | Standard Proctor Density ^a (Relative Density ^b shown in parentheses) |
|------------------------------------|---|
| Class I | Dumped |
| Class II | ≥85% standard (≥40% relative) |
| Class III | ≥90% standard (≥55% relative) |
| Class IV | Not approved for bedding material |
| Class V | Not approved for bedding material |

^a Standard Proctor Density per ASTM D698, moisture content must be ± 2% of optimum.

^b Relative Density per ASTM D4254.

- 3.3. **Utility Installation.** Water Lines and Sanitary Sewers: Limit clear on either side of the pipe to 12 in. Above the pipe, cut as wide as necessary to sheet and brace and properly perform the work. Provide class of bedding as shown. Install piping and appurtenances as specified.

Excavation for Appurtenances: Excavate sufficiently for valves, fittings, manholes, valve vaults, utility pull boxes and similar structures to leave at least 18 in. clear between the outer surfaces and the embankment or shoring that may be used to hold and protect the embankment wall. Install valves, fittings, manholes or valve vault structure, piping and appurtenances as specified. Any other-depth excavation will be refilled with lean concrete or other suitable compacted material approved by the Engineer, at no additional cost to the Owner.

- 3.4. **Final Backfill.** Criteria: Backfill trenches to ground surface with material as specified. Reopen trenches improperly backfilled to depth required for proper compaction. Refill and compact as specified, or otherwise correct the condition in an approved manner.

Take care to avoid contacting pipe or structure to be backfilled with compaction equipment. Do not use compaction equipment directly over the pipe until enough initial backfill has been placed to assure such equipment will not be damage or disturb the pipe.

All forms, lumber, trash and debris must be removed from trenches, manholes and other utility structures before backfilling.

Dispose of unacceptable backfill material and provide suitable material for backfill at no additional cost to the Owner.

- 3.4.1. **Open Areas.** Above the pipe zone, deposit earth backfill from excavated material, compact to minimum of 85% of maximum density per ASTM D698, while maintaining moisture within ± 2% of optimum. Excavated material placed must be free of rock greater than 2 in. in any direction.

Backfill for valves, fittings, manholes, utility pull boxes and other utility structures must be placed in accordance with applicable Specification Sections.

- 3.4.2. **Pavement Section.** Above the pipe zone to below the flexible base material, deposit earth backfill from excavated material, compact to minimum of 95% of maximum density per ASTM D698, while maintaining moisture within ± 2 % of optimum; or deposit ASTM D2487 Class II material in 6-in. lifts, compact to 40% relative density according to ASTM D4254.

For valves, fittings, manholes, valve vaults or boxes in pavement sections, backfill with Class II material to bottom of proposed pavement. Backfill material must be deposited in 6-in. lifts. Class II material must be compacted to 40% relative density according to ASTM D4254.

- 3.5. **Disposal of Excess Material.** Remove waste and excess excavated material from the construction site before final inspection. Legally dispose of material:

- at a licensed and approved site;
- on adjacent private property with written and notarized permission from the property owner;
- on Owner property with written and notarized permission from the Owner;
- all cost associated with waste material removal and disposal must be paid for by the Contractor.

- 3.6. **Placing and Laying.** Bury water lines as shown.

Do not exceed 75% of pipe manufacturer's recommendations for deflections from straight line or grade as required by vertical curves, horizontal curves, or offsets. If alignment requires deflections in excess of these limitations, use fittings.

Intersecting lines must be joined by an appropriate fitting.

Maintain separation of water line from sewer line in accordance with 30 TAC 290.

Any adjustment to obtain correct line must be made by tamping or removing soil and in no case by wedging or blocking pipe.

- 3.7. **Joints.** Install mechanical and flanged joints in accordance with manufacturer's recommendations.

Make push-on joints in accordance with manufacturer's recommendations. Lay spigot ends downstream and push-on to full depth.

- 3.8. **Anchorage of Fittings – Thrust Block.** Anchor tees, bends and plugged, valved or capped ends of lines of water mains with Class B concrete thrust blocks as necessary and as shown. Place blocks so that the joints will be accessible for inspection and repair.

- 3.9. **Install New Fire Hydrants.** Set hydrants plumb and locate pumper nozzle perpendicular to and facing the roadway. Set hydrants to grade, with nozzles at least 20 in. above ground. Locate control valve 6 ft. away from hydrant unless otherwise shown. Provide Class B concrete thrust blocks as shown.

- 3.10. **Service Connections.** Service connections must be installed at each house, building, or other locations as shown.

The Contractor must verify the actual location of each service connection and must confirm the location with the Engineer.

The service line is to be extended and terminated at the property line including the meter box. Customer must be reconnected and returned to service. 24-hr. notice must be given to the customer before cut-off.

Provide water service lines and include corporation and meter stops, meters, customer shut-off valve and meter box installed as shown.

Make service connections in accordance with the manufacturer's recommendations.

Connections must be located no closer than one foot from fitting or pipe joint.

Set top of meter box flush with ground.

- 3.11. **Disinfection.** Disinfect completed water lines with chlorine in accordance with the pertinent Items of the Specifications. Open and close valves in lines being sterilized several times during contact period.
- 3.12. **Testing.** The following described testing will be required for all new water lines. Upon completion of the required testing, Contractor must provide a signed and notarized affidavit certifying that the system has been tested and meets the applicable requirements.
- 3.13. **Hydrostatic Tests.** Pressure test completed water lines hydrostatically. Provide pumps, gauges, meters, and other equipment necessary for performance of tests.
- Pressure at the lowest point in the test section must be at least 100%, but not more than 120% of the pressure rating of the pipe.
- Minimum pressure at the highest point in the test section must not be less than 85% of the pipe's pressure rating.
- Leakage must not exceed 10 gal. per inch pipe diameter per mile of pipe per 24 hr.
- Minimum test duration must be 4 hr.
- Maintain records of date tests were performed, names of people in attendance, location of test section, brand name of pipe and pressure rating.
- Failed test sections must be repaired and retested at the Contractor's expense.
- 3.14. **Bacteriological Tests.** After disinfection and flushing mains, obtain representative samples and conduct bacteriological tests. Test in accordance with recognized AWWA standards.
- 3.15. **Examination and Preparation.** Examine utility routes and coordinate excavation work to eliminate installation conflicts.
- Allow room for stockpiling excavated material and utility construction material during utility construction.
- 3.16. **Trench Excavation.**
- 3.16.1. **Procedure.** Trenches must be excavated to indicated or specified depths by open cut method.
- Dispose of unacceptable backfill material and provide suitable material for backfill without additional expense.
- During excavation, stockpile material suitable for backfilling in an orderly manner far enough from the bank of the trench to avoid overloading, slides, or cave-ins.
- Grade as necessary to prevent surface water from flowing into trenches or other excavations.
- Cut walls of trench as close to vertical as the stability of the material and trench safety will allow. Remove stones as necessary to avoid point-bearing. Over-excavate wet or unstable soil from the trench bottom to permit construction of a more stable bed for pipe. Over excavation must be filled and tamped with clean dry sand, pea gravel, or other approved material to the required grade.
- Excavate the trench the proper width as shown, or as required by the Contractor's Trench Safety Program. If the trench width below the top of pipe is wider than specified in this section or shown, install additional backfill. No additional payment will be made for additional material or work required for installation.
- Accurately grade the trench bottom to provide proper bedding as required for pipe installation.
- If any excavation is carried beyond the lines and grades required or authorized, the Contractor must, at his

own expense, fill such space with suitable material and properly compact the material as directed. No additional payment will be made.

- 3.16.2. **Sheeting and Bracing.** If trench safety methods do not include sloping of trench walls, install sheeting and bracing; or use appropriate trench box necessary to support the sides of trenches and other excavations with vertical sides, as required by current OSHA regulations.
- 3.16.3. **Water in Excavation.** Keep work free from ground or surface water at all times. Provide pumps of adequate capacity or other approved method to remove water from the excavation in such a manner that it will not interfere with the progress of the work or the proper placing of other work.
- 3.16.4. **Trenching Progress.** Trenching operations for any individual utility work crew must not be in excess of 100 ft. ahead of pipe laying operations in city streets or 2,000 ft. in open country. Not more than two consecutive cross-streets may be closed to traffic by any individual utility work crew at any given time. Ensure no trenches are left open when work is not in progress. Temporarily backfill any open trenches with un-compacted material and install proper barricades at the end of each work day.
- 3.16.5. **Existing Lawns and Shrubbery.** The Contractor must take particular care to preserve existing lawns and shrubbery. Make minor pipe alignment as may be necessary.
- 3.16.6. **Existing Pavement.** Existing pavement over trenches must be removed to a width of 6 in. outside of the trench on each side. Remove to a neat line by sawing method. Take appropriate measures to prevent damage to existing pavement adjacent to the trench by wheels, tracks and stabilizers of excavating equipment. Remove brick pavement by hand, deliver and stack as directed by the Owner.
- 3.16.7. **Temporary Pavement.** Place a temporary pavement over an open-cut trench pavement section within the confines of an existing roadway pavement section including, but not limited to, asphalt (cold mix) and unimproved streets and roadways.
- Place and compact 6 in. of flexible base course under temporary pavement sections within roadways as shown on the drawings. Apply 2 in. Type D Cold Mix on top of flexible base course.
- Pavement replacement will be paid for by the linear foot, which will be total payment for tamping the backfill, placing and compacting the base material, finishing and replacing the pavement as per the section.
- 3.17. **Disinfection/Testing Procedure.** The examination, execution and quality control will be as follows.
- 3.17.1. **Examination.** Verify that piping system and structures have been cleaned, inspected, and pressure tested. Perform scheduling and disinfecting activities with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.
- 3.17.2. **Execution.** Provide and attach equipment required to perform the work of this section. Inject disinfectant into piping system, tank, or structure while filling. Disinfection agent may be introduced with permanent chlorination equipment when possible, or other means of application. Application of chlorine gas under pressure directly to the water is not permitted. Maintain disinfectant in system for 24 hr. Flush circulate and clean until required cleanliness is achieved; use municipal domestic water. Replace permanent system devices removed for disinfection.
- 3.17.3. **Field Quality Control.** New water mains must be thoroughly disinfected, then flushed and sampled before being placed into service. Samples must be collected for microbiological analysis to check the effectiveness of the disinfection procedure, which must be repeated if contamination persists. A minimum of one sample for each 1,000 ft. of completed water line is required, or the next available sampling joint beyond 1,000 ft. as designated by the Engineer.

4. MEASUREMENT

- CAST IRON FITTINGS - TON

- CUT AND PLUG WATER MAIN FOR TEST – EA
- TRENCH EXCAVATION SAFETY AND SUPPORT – LF
- DISPOSE HEAVY CHLORINATED WATER MAIN – LS
- INSTALL / RELOCATE NEW WATER SERVICE CONNECTION, METER AND BOX – EA
- ABANDON EXIST WATER LINE / PRESSURE GROUT (2 in. - 12 in.) – LF
- CUT AND PLUG EXIST WATER LINE (2 in. – 12 in.) – EA
- CONNECT PROPOSED WATER LINE TO EXIST WATER LINE – EA
- 2 in. GATE VALVE – EA
- 4 in. GATE VALVE – EA
- 6 in. GATE VALVE – EA
- 2 in. FLUSH VALVE - EA
- 2 in. CL200 PVC WATER LINE – LF
- 6 in. DR-25 C900 PVC WATER LINE – LF
- ENCASEMENT FOR 2 in. WATER LINE (BORE OR OPEN CUT) – LF
- ENCASEMENT FOR 6 in. WATER LINE (BORE OR OPEN CUT) – LF
- INSTALL NEW FIRE HYDRANT – EA
- REMOVE EXIST FIRE HYDRANT – EA
- REMOVE EXIST WATER METER – EA

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit prices bid for the various items of the work. The price is full compensation for removal of existing water line components (line, fittings, services, etc.), furnishing, hauling, placing, and installing the materials; for inspecting, disinfection, and testing; and for other materials, labor, equipment, tools, and incidentals. All joint restraints, tees, fittings, reducers, metal detectable table, etc. are considered subsidiary to the individual line items for water line installation.