

SPECIFICATIONS FOR
WATERLINE CONSTRUCTION

GENERAL

Right-of-ways

The Owner will obtain all rights-of-ways or easements through private property that is necessary to the prosecution of the project.

City, County, State Highway and Railway Crossings

Where the work encroaches upon the right-of-way of any City Street, County Road, State Highway or Railway Company right-of-way, the Owner will secure the necessary right-of-way.

The Contractor shall observe all the regulations and instructions of the City, County, Railway Company or the State Highway Department, as to the methods of doing the work, or precautions for safety of property and the public. The City, County, Railway Company or the State Highway Department shall be notified by the Contractor not less than five (5) days previous to the time of his intention to begin work on their respective rights-of-way. It is contemplated that the City, County, Railway Company or State Highway Department will have representatives on the site when the work is in progress on their respective rights-of-way, and their regulations must be observed.

Proper barricades shall be placed and maintained to assure maximum traffic and pedestrian safety, or as directed by City, County, Railway Company or State Highway authorities. Tunneling will not be permitted except where required under the City, County, Railroad or State Highway or upon written approval of the Engineer in each case which arises.

Owner will make formal application for rights to cross city street, county roads, canals, railroads, highways, etc., but Contractor must cooperate fully with agencies involved while constructing in areas controlled by such agencies. The Contractor shall make all necessary arrangements for crossing, passing, or removing and replacing fences, roads, street surfaces, telephone and telegraph lines and power lines, pipelines, culverts disturbance of shrubs, sod, etc., and shall include the cost of such work in his unit price bid on the pipe in place.

Trees, Fences, and Incidentals

The removal and replacement of trees, fences, street signs, curb, gutter, sidewalks, driveways, and other minor items will not be measured for payment as separate contract pay items, but the cost of such removal and replacement shall be included in such contract pay items as are provided in the proposal and contract, unless a pay item for such work is provided in the bid sheet.

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Where trees, plants, shrubbery, etc., are adjacent to the line of the work and are not to be removed and replaced, or removed, the Contractor shall protect such trees, plants, shrubbery, etc., by substantial barricades and guards and shall not permit machinery, or employees to scrape, tear the limbs from or damage or attach guy cables to them and if in the opinion of the Engineer such trees, plants, shrubbery, etc., would be damaged by machinery, hand excavation may be required. Contractor shall be responsible for all damages to adjacent trees, plants, shrubbery, etc.

MATERIALS

All pipe, fittings, and materials shall be new and approved by the Engineer before being installed.

A. Asbestos Cement Pipe and Fittings

Asbestos Cement Pipe shall be Class 150 as manufactured by Johns Manville, Keasby and Mattison Company, or equal. Pipe shall conform to A.W.W.A. Specifications C400-64T and shall meet the approval of Underwriter's Laboratories, Inc.

Fittings: Cast Iron -Fittings for asbestos cement pipe shall be A.W.W.A. Standard all bell, Class "D", suitable for A.C. pipe line construction.

Joints: Joints shall be Johns-Manville "Ringtie" or approved equal.

B. Cast Iron Pipe and Fittings

Cast Iron Pipe: All cast iron pipe unless otherwise designated shall conform to Federal Specifications WW-P - 421 (Current edition), Bell and Spigot Class 150.

Cast Iron Fittings: Cast iron fittings for bell and spigot pipe shall conform to the A.W.W.A. Standards and shall be Class "B" for all fittings 4 inches or larger unless otherwise specified.

Flanged Pipe: Flanged pipe shall be A.W.W.A. Class 150 with 125 pound American flanges.

Cast Iron Flanged Fittings: Cast iron flanged fittings shall conform to the requirements of the American Standard Class 125 unless otherwise specified or shown and must conform to the dimensions as shown in the plans.

C. Galvanized Steel and Iron Pipe Fittings:

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Steel Pipe: Unless otherwise specified, all steel pipe shall conform to A. S. T. M. Specifications 120-46 for "Hot-Dipped Galvanized Buttwelded Steel Pipe, Standard Weight."

Wrought Iron Pipe: All wrought iron pipe shall be genuine wrought iron and conform to the A.S.T.M. Specifications A- 72-45, for Extra Heavy Pipe. Pipe shall be galvanized to conform with A.S.T.M. Specifications A-153-42T.

Fittings: All fittings for steel and wrought iron pipe shall be Malleable Screwer Fittings, American Standard 150 pound conforming to A.S.A. B16-C Specifications and shall be galvanized to conform with A.S.T.M. Specifications A-153-42T. Unions shall be brass seat, ground joint, equal to Crane Number 1280.

D. P.V.C. Pipe for Rural Water Systems All plastic pipe for Rural Water Systems

All plastic pipe for Rural Water Systems (FmHA approved) shall be rigid polyvinyl chloride (P.V.C.) and shall be Class 160 (SDR 26) for diameters 4" to 12" and Class 200 (SDR 18) for diameters 3" or smaller with rubber joints and shall conform to A.S.T.M. Commercial Standard CS 256-63 and National Sanitation Foundation Testing Laboratories. All plastic pipe of diameters larger than 12", shall meet the requirements of UNI-BELL-B-11 PVC pressure pipe. These larger diameter pipe are designated PR 165 pipe and shall meet requirements of DR 25. Pipe shall meet all Burst Tests, Pressure Tests, Impact Tests, and Chemical Requirements in accordance with proper A.S.T.M. test procedures.

Couplings and fittings shall be furnished by the manufacturer and shall accommodate pipe for which they are to be used. For 4 inch or larger PVC pipe, cast iron or ductile iron fittings should be specified for all tees and elbows.

All pipe shall be marked showing the manufacturer's name and schedule. The pipe and fittings shall be free of defects in material and workmanship. All pipe shall be laid and embedded in accordance with the manufacturer's specifications. Tap collars or tapping saddles for plastic pipe may be used for house connections.

E. AWWA C-900 PVC Municipal Water -Pipe

All plastic pipe for Municipal Fire Rated Water Systems shall be rigid polyvinyl chloride (PVC) and shall conform to AWWA C-900 PVC Pressure Pipe DR-18 Class 150. Pipe shall meet all Burst Tests, Pressure Tests, impact Tests, and Chemical requirements in accordance with proper ASTM test procedures and AWWA C-900 requirements.

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Couplings and fittings shall be furnished by the manufacturer and shall accommodate pipe for which they are to be used.

All pipes shall be marked showing the manufacturer's name and schedule. The pipe and fittings shall be free of defects in material and workmanship. There shall be furnished by the plastic pipe manufacturer a five (5) year warranty from the date of installation covering difficulties arising because of workmanship of faulty raw materials in the specified PVC pipe. If failure occurs within the time specified due to either of the foregoing factors, the manufacturer will supply, free of charge, freight prepaid, a quantity of pipe equal to that which proved to be defective and equipment charges incurred on the job site in replacing the defective pipe and/or fittings with new pipe and/or fittings.

F. Valves

1. Gate Valves:

- a. Gate valves shall only be used for pipe sizes of 12 inches and smaller, unless otherwise noted on the plans.
- b. Resilient seat gate valve shall be used and shall conform to AWWA C 509. The gate valve shall be a non-rising stem type with inside screw and 10" ring seals. The valve shall have a standard hub equipped with a square operating nut. The body-to-bonnet and bonnet-to-bonnet cover shall use "O" rings as seals.
- c. The resilient seal shall be mechanically retained or bonded on the valve gate (wedge disc).
- d. The gate valve shall have a protective coating inside of fusion-bonded epoxy approved for potable water.
- e. The valve stem shall comply with AWWA C 509. The material for the valve stem shall be brass or bronze, and shall have a minimum yield strength of 20,000 psi and minimum tensile strength of 60,000 psi. The valve stem shall be compatible and interchangeable with the equivalent sized double disc gate valve models.
- f. Gate valves shall have a 2-inch square operating hub nut.
- g. The number of turns to open the valve shall be the same or less than the equivalent sized double disc gate valve models. Maximum input torque to open and/or close the valve shall be 200 foot pounds for a 4-inch valve and 300 foot pounds for 6-inch under a working pressure of 200 psi.

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- h. Before the Work will be accepted, the CONTRACTOR shall provide the ENGINEER with a completed "Water Valve Data Card".
- i. Gate valves shall be American Darling, Metroseal by U.S. Pipe, Mueller, or approved equal.

Check valves: Check valves for bell and spigot and flanged pipe shall be iron body, bronze mounted, full swing check, tested to 300 pounds and having a working pressure of 150 p.s.i. Check valves shall be suitable for horizontal or vertical mounting as required and shall be spring and weight loaded.

G. Valve Boxes

- 1. Valve boxes, ring and covers shall be the type, size and material as shown in Standard Detail Drawings.
- 2. No valve box shall be spaced over without the permission of the ENGINEER. Paving material shall not remain on valve box covers overnight.
- 3. Valve boxes shall be fabricated using 6-inch cast-iron sliding type pipe shaft with cover and base casting.
- 4. Drop covers for valve boxes shall be marked "WATER" using lettering casted in the cover by the manufacturer.
- 5. Top of valve box shall be set at finished grade unless otherwise noted.

H. Fire Hydrants

- 1. Fire hydrants and their extensions shall be in accordance with AWWA C 502, traffic type.
- 2. Fire hydrants shall have one 5 1/4 inch diameter valve opening; 6-inch mechanical joint of slip-on inlet connection; two 2 1/2 inch hose nozzle connections; and one 4 1/2 inch steamer nozzle with National Standard Fire Hose Coupling Screw Threads or as specified by the OWNER.
- 3. Fire hydrants shall have a bronze or cast iron, pentagon, operating nut, be designed for 150 psi., working pressure service, and have a normal bury of 4 to 4 1/2 feet unless field conditions require a deeper bury, in which case extensions will be used

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- so as to bring the bottom of the break-off flange 2 to 8 inches above the top of finish grade.
4. The pipe fittings and fire hydrants starting at the street main and ending at the fire hydrant itself shall be lying in a line perpendicular to the street's centerline or radially on a curvilinear installation.
 5. Fire hydrants shall be installed in as near a vertical position as possible and shall have no more than 1/2 inch variation from a vertical line between the breakway flange and the top of the fire hydrant.
 6. Hydrants shall be dry barrel, post-type with compression main valve closing with pressure. They shall have a field lubrication capability. Hydrants shall have a bronze seat ring threaded into a bronze drain ring or bronze or cast iron bushing.
 7. Hydrant exterior below the ground line shall be coated with asphalt varnish, and the exterior painted from the top to a point one foot below the ground level flange, consisting of one coat rust inhibitive primer.
 8. The bottom plate of the main valve shall be epoxy coated. The shoe of the fire hydrant shall have a 6-inch mechanical joint connection. The inside shall be epoxy coated to prevent corrosion.
 9. The nozzle shall be threaded in-place and retained by stainless steel locks.
 10. Hydrant body shall be threaded to receive the threaded nozzle. Nozzle shall be secured by a stainless steel locking device.
 11. Fire hydrant shall contain two drain outlets. The drain outlets shall be constructed of bronze. Hydrant shall be provided with a pentagon operating nut to open counter clockwise and shall have an anti-friction washer between the hold-down nut and the operating nut.
 12. Fire hydrants shall be installed at locations as shown on construction plans and in accordance with Standard Detail Drawings.
 13. No project will be accepted by the OWNER until all hydrants are operational, accessible and have been tested.
 14. Before the work will be accepted, the CONTRACTOR shall provide the ENGINEER with a completed "Fire Hydrant Data Card".

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15. Hydrants shall be limited to the following unless prior written approval is provided by the ENGINEER:

- a) Mueller Centurion A-423
- b) American Darling B-84-B
- c) Kennedy Guardian K-81A
- d) U.S. Pipe Metropolitan

I. Valve Stem Extensions

- a) Extension stems shall be provided as necessary to situate the operating nut no greater than 18 inches below the valve cover.
- b) Extension stems shall be equipped with stem guides affixed to the valve box at intervals not to exceed ten feet.
- c) Stem guides shall be considered a part of the extension. Extension stems and stem guides shall be manufactured items or approved equal.

J. Water Meter and Water Meter Stub Out Installation (Rural Water Systems only)

This specification applies to water meter installations related to water system customers.

Water Meter Specifications

The water meter shall be suitable for cold water and shall have a multi - jet impeller and a direct drive water lubricated register. The meter shall conform to American Water Works Standard, C708 (latest revision) in every respect, including size and length.

The meter shall have a non-corrosive Water Works bronze outer case which will have a minimum copper content of 75 percent with a separate measuring chamber which can be easily removed from the case without any pipeline disconnect. Meter cases shall have the calibration port located down stream. The meter shall have cast on them, in raised characters, the size and direction of flow through the meter.

The register must be of the straight reading type with external pinion gearing and six movable odometer wheels with the numbers to be a minimum of 3/16" in height. The register shall be of the water lubricated type. The register shall have a low flow leak indicator capable of showing a leak the minimum of 1/8 GPM. The register covers and retaining rings are to be of non-corrosive water works bronze which will have a minimum copper content of 57 percent.

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The measuring chamber shall be of a suitable synthetic polymer and easily removable from the main case without pipeline disconnect. The impeller shaft shall be an integral part of the impeller and shall be supported by bearings at both ends. The motion of the impeller shall be transmitted to the register through the use of a direct drive without any inter-mediate magnetic coupling. All impeller assemblies shall be interchangeable in all measuring chambers assemblies of the same size.

The meter must be provided with a corrosion resistant strainer providing coverage of at least double the nominal pipe size area and be easily removable with no pipeline disconnect necessary.

Meter Box

The plastic meter box shall be constructed with a hinged self closing cast iron reading UD and available dual knockouts. The meter box shall be 17 inches in length by 11 3/4 inches in width and 12 inches in depth. The meter boxes shall be DFW/HPI Model D-1200, or equal.

Water Service Tubing

All water service tubing shall be polyethylene SDR-9, CTS O. D. The tubing shall comply with ASTM D-2737 and shall be made from material having standard PE Code Designation PE 3408 and carrying NSF approval.

CONSTRUCTION METHODS

Trench Excavation

Unless otherwise ordered by Engineer, all trenches shall be excavated to a width not less than the internal diameter of the pipe plus 12 inches. The Contractor shall do all excavation of whatever substances encountered to depth specified.

Excavation shall not be carried below the required level. Excess excavation below required level shall be backfilled at Contractor's expense with earth, sand, or gravel, as directed by Engineer, and thoroughly tamped.

Unstable soil shall be removed and replaced with gravel which shall be thoroughly tamped. Engineer will determine the depth of removal, and replacement of unstable soil shall be at Contractor's expense. Contractor shall furnish pumps to keep excavation free of water and also any necessary sheeting, shoring, or bracing to prevent cave-ins.

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Banks of trenches shall be vertical, and bell or coupling holes shall be accurately located under each pipe joint and excavated to size by hand. Pipe shall lay uniformly, and be supported on bottom of ditch along its entire length.

Temporary bridges or crossing shall be built by Contractor where required to maintain traffic.

Pipe Laying

In general, entire pipe line shall be installed at a depth resulting in a "cover" of 30 inches. Proper barricades and flares shall be placed and maintained to assure maximum traffic and pedestrian safety, or as directed by Local Railroad or State Highway authorities.

Clearing will be required along some lines. Where trees, stumps, or roots are encountered, they shall be removed and disposed of as the Engineer may direct. All roots shall be cut off flush with the sides of the trench. Tunneling will not be permitted except where required under a City street, County road, Railroad and State Highway, or upon written approval of the Engineer in each case which arises.

Owner will make formal application for rights to cross city street, county roads, canals, Railroads, Highways, etc. but Contractor must cooperate fully with agencies involved while construction in areas controlled by such agencies. The Contractor shall make all necessary arrangements for crossing, passing, or removing and replacing fences, roads, street surfaces, telephone and telegraph lines and power lines, pipe lines, culverts, disturbance of shrubs, sod, etc., and shall include the cost of such work in his unit price bid on the pipe in place.

Ditching and pipe laying shall be uniformly in a straight line and to uniform elevations unless otherwise specified on plans. Pipe fittings and valves shall be carefully handled to avoid damage, and while they are suspended over the trench before lowering, they shall be inspected for defects. Any defective, damaged, or unsound material shall be repaired or replaced as directed by the Engineer.

As directed by the Engineer, the pipe shall be laid directly on the trench bottom or on earth mounds.

1. Pipe laid on trench bottom: Pipe shall be laid directly on a trench bottom containing coupling holes and shaped to provide continuous contact with the pipe between coupling holes.

Before the pipe is lowered into the trench: 1) a coupling hole shall be dug with sufficient length, width, and depth to permit assembly and provide a minimum clearance of 2 inches between coupling and undisturbed trench bottom; and 2) the trench bottom between coupling holes shall be made flat and cut true and even to grade so to provide continuous contact of the trench bottom with the pipe.

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2. Pipe laid on earth mounds: Pipe shall be laid on earth mounds of a size adequate to hold the pipe in alignment and to maintain a 2 inch minimum clearance from coupling to undisturbed trench bottom. Earth mounds shall be of selected backfill material tamped in place. Each pipe shall be laid on two mounds with center of each mound placed one-fifth of the pipe length from each end. The trench shall be excavated a minimum of 2 inches below the grade of the bottom of the OD of the couplings, and high spots between couplings shall be leveled so as to maintain a minimum of 2 inches under the pipe barrel. The earth mounds shall be tamped firmly in place and raised to a height that will allow for placement of the pipe so as to maintain, before backfilling, a minimum clearance of 2 inches between the trench bottom and the pipe and coupling.

Implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and efficient execution of the work. All pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. All foreign matter or dirt shall be removed from the interior and machined ends of pipe and accessories before it is lowered into position in the trench. Pipe shall be kept clean by means approved by the Engineer during and after laying. The machined ends of pipe to be jointed, the coupling grooves, and rubber rings shall be cleaned immediately before assembly, and assembly shall be made as recommended by the manufacturer. Each pipe joint shall be sealed with a coupling consisting of an asbestos-cement sleeve and two rubber rings. The location of field-assembled rings shall be checked with a suitable gauge to verify that rubber rings are in the required position. Pipe shall not be deflected either vertically or horizontally more than the limits recommended by the manufacturer.

When pipe laying is not in progress, the open ends of installed pipe shall be closed by approved means to prevent entrance of trench water into the line. Whenever water is excluded from the interior of the pipe, enough backfill shall be placed on the pipe to prevent floating. Any pipe that has floated shall be removed from the trench and relaid as directed by the Engineer. No pipe shall be laid in wet trench conditions that preclude proper bedding, or on a frozen trench bottom or when, in the opinion of the Engineer, the trench conditions or the weather are unsuitable for proper installation.

When rigid joints, that is, those formed by poured or caulked joint materials, or both, or by bolts with rubber ring seals, are used at the fitting, the length of the pipe fitted into the bell of the fitting shall not be more than 3 '-3" in pipe of 6 inch diameter and smaller, or 6'-6" in pipe of 8 inch in diameter and larger.

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When a rubber ring is used to make the seal and flexibility is provided by a grooved design profile similar to that of the coupling used to join pipe between fittings, up to a full 13 foot length may be used.

With all the rigid joints named above, the pipe connecting any two valves or fittings shall be in two or more lengths jointed with one or more couplings to provide flexibility. If a flexible seal is used, a single 13 foot or shorter length may be used to connect the two fittings without any intermediate coupling.

General

Each cast iron valve, hydrant, or fitting connected to asbestos-cement pipe shall be either equipped with a bell with an inside diameter large enough to receive the pipe and caulking of at least 1 inch thickness around the full circumference of the pipe, or have a profile that presents a seal to be made between the machined pipe end and the bell of the fittings with a rubber ring.

Before valves, hydrants, or fittings are laid, all lumps, blisters, and excess coating shall be removed from the bell. The inside of the bell shall then be wire-brushed and both the inside of the bell and the spigot end of the pipe wiped clean and dry. All surfaces to be joined shall be kept clean until joints are made. As directed by the Engineer, bell and spigot joints shall be sealed with either rubber rings or lead.

Wet Connections

Schedules of existing fittings and proposed new fittings needed to make wet connections to existing water lines as shown on plans are estimates only. It is to be recognized that after existing lines and fittings are uncovered that some discrepancies will occur. Where discrepancies occur, the Contractor shall request a decision by Engineer as to how connection in question shall be made.

Contractor shall plan his work concerning wet connections in such a way that a minimum of inconvenience shall occur to existing water customers due to water service interruptions.

Before water service interruptions are made to customers, Contractor shall notify designated official, and cooperate with operating personnel in every way to minimize service interruptions due to wet connections.

It is also to be recognized that in certain locations other utility lines or conduits will be obstructions in the normal path of proposed water lines. In such instances gravity lines of all kinds hold priority as to grade over water pressure lines, gas lines, electric conduits, or other

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obstructing underground conduits. Where other obstructing conduits or combination of conduits are encountered, Contractor is to analyze conditions carefully and then use best judgment in determining proper method of proceeding through obstructed area with water line construction.

Backfilling

Before pipes have been tested and approved, partial backfilling shall be done with approved material free from large clods.

Backfill material shall be placed evenly around and over pipe in 6 inch maximum layers. Each layer shall be thoroughly and carefully tamped until six inches of cover exists over pipe.

Remainder of backfill material may be handled by machine. A final mound of backfill earth, approximately 4 inches higher than adjacent ground level, shall be left over immediate area of trench excavation.

Where pavement is cut in locations other than State Highway, whether gravel topping or hard surfaces, the surfacing shall be restored to its original finish and in equal condition as found at time of beginning of construction.

Where trenching is done in paved areas, or other traffic areas, the backfilling and dirt settling shall be accelerated by complete and thorough water tamping of all backfill dirt, and shall be compacted to a minimum of 95% Standard Proctor the full depth of the trench.

In traffic areas, including individual driveway, Contractor shall restore traffic surfaces to usable condition as rapidly as practical upon completion of pipe installation. In such locations, Engineer will rely upon hydrostatic test to determine acceptability of construction.

All excess dirt from all construction work shall be disposed of promptly by Contractor, either by hauling or at direction of Engineer.

Highway Crossing

The crossing of highway rights-of-way on State Highways and boring under the pavement shall be done under the supervision of, and in accordance with, the requirements of the State Department of Highways and Public Transportation, which includes:

1. That the line is placed in a casing of the size, type, and length indicated.

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2. That the portion of the casing under the pavement and for 10 feet each side of the pavement be placed through a bored hole of approximately the same diameter as the casing unless otherwise noted.
3. That the top of the casing be placed a minimum of 24 inches below the existing ditch grade or at specified elevations.
4. That all paved private drives and crossroads lying within state Highway right-of-way shall not be cut. Lines shall be placed beneath these drives or roads by boring or jacking. No encasement is required.
5. That all backfilling of trenches shall be thoroughly compacted, excess dirt disposed of, and right-of-way reshaped to its original section.
6. The Contractor shall have a copy of the permit at the time of making the crossing.
7. The Contractor shall notify the Maintenance Construction Foreman forty eight (48) hours prior to starting construction on the highway right-of-way.

In cutting walks or other roadways, care shall be taken to replace such walks or roadways with the same type of materials, new, as are removed and in as good condition as before the Contractor entered upon the same.

Railroad Crossings

All work done on railroad right-of-way shall be done in accordance with the requirements of the Railroad Company. Water lines crossing under the track shall be in encasement pipe which shall be placed in a bored hole. The size, length, and type of encasement pipe, and other details, shall be as shown on the plans.

Work on the right-of-way shall be performed between the hours of 8:00 A.M. and 5:00 P.M., Monday through Friday, inclusive. The Contractor shall notify the Railroad's Roadmaster prior to beginning work, in order that a representative may be present when installation is made under the tract.

Concrete Blocking

Reaction or thrust blocking shall be applied to all tees, plugs, caps, and at bends deflecting 22 ½ degree or more. The amount of blocking shall be as shown on the plans or as determined by the Engineer.

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Hydrostatic Tests

The Contractor shall provide all necessary equipment and shall perform all work required in connection with the tests. All pressure pipe, fittings, and valves shall be subjected to a hydrostatic pressure of 80 p.s.i. Air pressuring method will not be allowed.

Each section tested shall be slowly filled with water, care being taken to expel all air from the line. If necessary, the pipes shall be tapped at high points to vent air.

The required test pressure shall be applied, for not less than 24 hours. The hydrostatic tests must be performed in presence of Engineer, and pressure maintained until final approval of the test is given by Engineer. Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage under the test pressure. No pipe installation will be accepted until, or unless, this leakage is less than fifty gallons per twenty-four hours per mile of pipe per inch nominal diameter of pipe, including service connections. Engineer will inspect all pipe, fittings, valves, and joints under test. Any faults found to be due to improper workmanship shall be corrected by Contractor before further backfilling will be allowed.

Water for testing, flushing etc., will be at the Contractor's expense. The Contractor shall make arrangements with the City for the purchase of water.

Sterilization of Completed Line

Before being placed in service, the entire line, including service connections, shall be chlorinated. Chlorine may be applied by the following methods: chlorine gas-water mixture or hypochlorite and water mixture.

The chlorinating agent shall be applied at the beginning of the section adjacent to the feeder connection and shall be injected through a corporation cock or similar connection.

Water shall be fed slowly into a new line with chlorine applied in amounts to produce a dosage of 40 to 50 p.p.m. sterilizing solution must be held in pipe for a period of eight hours.

After chlorination the water shall be flushed from the line at its extremities until the replacement water tests are equal chemically and bacteriologically to those of the permanent source of supply.

Cleaning Up

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As various items of the work are completed, the Contractor shall clean up all debris and waste from the work and dispose of the same at his expense. The ground shall be smoothed up and left in a condition to drain.

Spacing of Water lines and Sanitary Sewers

Water lines and sanitary sewers shall be installed no closer to each other than nine feet. This spacing has been maintained for all new construction as shown on the plans. However, if during the course of construction, lines are encountered which do not comply with this provision, the sewer line shall be replaced with pressure type cast iron pipe or the equivalent of 150 p.s.i. pressure pipe with water tight joints used in water line construction for the nine foot clearance.

Payment

Payment for the work prescribed in this item shall be in accordance with the unit price bid as stated in the proposal. The price shall be full compensation for all material, labor, equipment and incidentals necessary to complete the work.