PART ONE - GENERAL

1.1 DESCRIPTION

1.1.1 Work Included: Furnish all materials, labor and incidentals necessary to install a complete water line system including, but not limited to water main piping, fittings, tapping assemblies, valves, fire hydrants, air release and/or vacuum assemblies, services vaults, thrust blocking and any other work and appurtenances required for proper completion of the work.

PART TWO - PRODUCTS

2.1 GENERAL

2.1.1 All materials furnished shall conform to these specifications, the construction plans and any governing specifications referred to.

.2 WATER LINE PIPE

2.2.1 Polyvinyl Chloride (PVC) SDR - 18, C-900:

2.2.2 Location: All waterlines shall be located five- (5') feet inside the street right-of-way or in the middle of the line easement unless otherwise approved by the City Engineer. Waterlines shall be located on the opposite side of the street from sanitary sewer lines.

2.2.3 Polyvinyl Chloride (PVC) SDR - 18,C-900: This pipe shall be SDR 18 (minimum) Class 150 psi, cast iron pipe size o.d. based that meets all the requirements of ANSI/AWWA Standard C-900. All pipe shall be suitable for use as a pressure conduit at a maximum hydrostatic working pressure of 150 psi at 73 deg. F. Provisions must be made for expansion and contraction at each joint with an elastomeric ring and integral thickened bell as part of each joint. The pipe shall bear the National Sanitation Foundation Seal of Approval for potable water.

The pipe shall be designed to pass without failure for 1000 hours at pressure of 500 psi when tested in accordance with ASTM Method D1598. It shall also be designed to pass without failure a pressure of 755 psi applied in 60 to 70 seconds when tested in accordance with ASTM Method D1599.

The Manufacture shall furnish an affidavit that all delivered materials comply with requirements of the above specifications.

The OWNER and/or ENGINEER shall at all times have free access to the

manufacturer's plant while production is in progress and may at any time refuse to accept pipe made when the plant is failing to follow the stipulations of the specifications in regard to workmanship, or failing in provisions to insure a uniform product coming within the permissible variations of the specifications. The OWNER and/or ENGINEER may reject pipe if adequate means and methods are not provided so as to insure the manufacture of a product of uniform quality.

2.2.4 Polyvinyl Chloride (PVC) Schedule 40: Pipe and fittings shall comply with ASTM Standards D-1785 and D-2466. Solvents shall comply with ASTM Standard D-2564. The pipe shall bear the National Sanitation Foundation Seal of Approval for potable water.

2.2.5 Ductile Iron Pipe: Ductile iron pipe shall comply to ANSI/AWWA C150/A21.50 and C151/A21.51. Ductile iron pipe shall have an outside bituminous coating as specified in ANSI A21.51(AWWA C151) and a standard cement lining as detailed in ANSI/A21.4 (AWWA C104) and a class as specified on the bid proposal form. Polyethylene encasement as specified in ANSI/AWWA C105/A21.5 shall be provided for all ductile iron pipe and fittings. All ductile iron pipe shall be approved by Underwriters Laboratory.

Joints shall be of the bell and spigot type with confined rubber gasket.

2.3 Ductile Iron Fittings: Fittings for all pipe shall be ductile iron mechanical joint or push-on joint AWWA C153 Class 350 unless otherwise specified. Fittings shall be cement-lined. Where flanged fittings are specified, fittings shall conform to AWWA C110 with cement lining.

2.4 Joints: Plain End - Plain ends for use with mechanical couplings shall be square cut, then beveled at 30 deg. for at least 1/8-inch and the inside and outside edge burrs shall be removed. The pipe shall be sufficiently free from indentations, projections, or roll marks at each end to make a tight joint.

2.5 GATE VALVES

2.5.1 General: Gate valves, two (2) inches through twelve (12) inches shall be designed for a working pressure of 200 psi. Valves shall conform to AWWA C500 with iron bonnet (bronze mounted), non-rising stem double-disc (parallel seat type), O-ring stem seals and 2"x2" square operating nut.

Valves shall open when operating nut is turned to the left (counterclockwise). Valve ends shall be mechanical joint conforming to the requirements of ANSI/AWWA C111/A21.11. Tapping valves shall conform to above specifications except that the connections shall be ANSI B16.1, Class 125 flange on one side (inlet) and mechanical joint on the other (outlet) or as specified.

or approved equal.

2.5.2 Valve Boxes: Valve boxes shall be the H-10346,562-A, two-piece sliding type, 5-1/2 shaft, 24 - 36" extension, with drop cover marked water as manufactured by the Mueller Co. or equal.

2.6 Tapping Sleeves: Tapping sleeves shall be mechanical joint tapping sleeves designed for 200 psi working pressure and with Class 125 outlet flange, as manufactured by Mueller or approved equal. Sleeves shall be on the type and size to make the required tap as shown on the plans. CONTRACTOR is to verify O.D. of pipe prior to ordering.

2.7 FIRE HYDRANTS

2.7.1 Type II (Flanged Fittings):

A. General: Hydrants shall conform to AWWA C502, the following specifications, and shall be the Centurion Fire Hydrant, Catalog Number A-423, manufactured by the Mueller Company, Chattanooga, Tennessee, or the Reliant Fire Hydrant, Catalog Number 929, manufactured by the M & H Valve Company, Anniston, Alabama or American Darling Model B84B as manufactured by American Flow Control, Beaumont, Texas.

Working Pressure	Minimum 150 psi
Size of Valve Opening	Minimum 5"
Diameter of Inlet Connection	6-inch
Type of Inlet Connection	Flange joint
Number & Size of Hose Connection	2-2 1/2", 1-4 1/2"
Nozzle Arrangement	All in the same plane
Nozzle Thread	ASA Standard
Nozzle Cap Chains	None
Nozzle Cap Washer	Rubber
Direction to Turn to Open	Left(counter clockwise)
Shape & Size of Operating & Nozzle Cap Nut	5-sided, 1 - 1/2" from flat to point
Color above ground-barrel & dome	Red
Color, Nozzle Caps & Top Nut, including shield	Red

B. Auxiliary Gate Valve: Each hydrant shall come with an auxiliary gate valve which meets or exceeds the requirements of this specification and has a flanged connection to the hydrant and flanged connection to the line tee.

2.8 CONNECTIONS TO EXISTING SYSTEM

2.8.1 Transition Couplings: All transition couplings four (4) inches and larger shall be Dresser Style 162, with Al-Clad factory applied vinyl coating, or approved equal.

The CONTRACTOR shall field determine the type of pipe to be connected at the start of the project and order appropriate gaskets.

2.9 SERVICES

2.9.1 Service Lines: Service Lines shall be TYPE "K" soft copper tubing in compliance with Federal Specifications WW-T-99 and the latest revision of ASTM B-88. Service lines shall be 3/4" unless otherwise shown on the drawings.

2.9.2 Tapping Saddles: Tapping saddles for 3/4" to 2" taps shall be double strap, malleable iron saddles with AWWA tapered threads. Saddles shall be Rockwell model 313.

2.9.3 Corporation Stops and Valves: Corporation stops and valves shall be bronze stops with AWWA tapered threads and a compression fitting suitable for use with ASTM B88 type "K" soft copper tubing. Corporation stops and valves shall be Mueller No. H-15000 and shall be 3/4" unless otherwise shown on the plans.

2.9.4 Curb Valves and Stops: Curb valves and stops shall be bronze stops with a compression fitting suitable for use with ASTM B88 type "K" soft copper tubing on one end and with an iron pipe thread on the other end. Curb valves and stops shall be Mueller No. H-15275 and shall be 3/4" unless otherwise shown on the drawings.

2.10 Blow-off Assemblies: Blow-off assembly shall consist of one (1) gate valve, valve box and cover, and various piping, fittings, and connections as shown in the drawings. Gate valve and gate valve box cover shall conform these specifications. At each 90 degree bend, a 2000 lb. Concrete thrust block shall be installed, conforming to the specification for CONCRETE THRUST BLOCKS AND COLLARS. In addition, a protective slab shall be constructed with 3000 psi Class A concrete in accordance with the drawings.

2.11 Air Release Valves: The Combination Air Release & Vacuum Valve shall perform the functions of a small orifice air release valve as well as the functions of a large orifice air release and vacuum valve. The valve shall be comprised of small orifice assembly and a large orifice assembly.

The large orifice assembly shall exhaust air from a pipeline during the initial filling of the pipeline. The large orifice assembly shall not blow shut while exhausting air, even while venting air at sonic velocity. When all air has been exhausted from the pipeline, the large orifice float ball shall be buoyed up to seat

tightly against a resilient seat ring. The large orifice float ball shall remain tightly closed while the pipeline is under positive pressure. Should the pipeline pressure fall below atmospheric pressure, the large orifice float ball shall fall away from the seat ring and permit air to enter the pipeline.

The small orifice assembly shall automatically release air accumulations from the pipeline while under positive pressure. When the valve body fills with air, the small orifice float ball falls to open the small orifice and exhaust the air to atmosphere. When the air has been exhausted, the small orifice float shall be buoyed up and tightly close the small orifice.

The valve body, small orifice cover, and large orifice cover shall be constructed of cast iron (ASTM A126-B). The small orifice float ball and the large orifice float ball shall be free floating within the valve body. Resilient, Buna-N seats shall be provided for both the large and small orifices.

Air release valve shall be Apco Model 145C, or approved equal.

PART THREE - EXECUTION

3.1 WATER LINES

3.1.1 Well fitted stoppers or bulkheads shall be securely placed in all openings and in the end of the line when construction is stopped temporarily and at the end of each day's work. It shall be the responsibility of the CONTRACTOR to deliver to the OWNER a pipeline which is clean throughout it's entire length.

3.1.2 Bedding and backfill shall be in accordance with detail as shown on the Plans and these specifications.

3.1.3 Proper implements, tools, and facilities shall be provided and used by the CONTRACTOR for the safe and convenient prosecution of the work. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

3.1.4 All foreign matter or dirt shall be removed from the inside of the pipe and appurtenances before lowering into the trench and the pipe interior shall be kept clean during and after laying. A swab shall be kept in the pipeline as the pipe is being laid. Care shall be taken to prevent dirt from entering the joint space and at times when pipe laying is not in progress, the open ends of the pipe shall be closed by installing a plug or cap of sufficient design to prevent trench water, foreign matter, and dirt from entering the pipeline.

3.1.5 Lubricant furnished for lubricating joints shall be non-toxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe

material and shall not impart taste or odor to water. The lubricant containers shall be labeled with the manufacturer's name.

3.1.6 Cutting of the pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or pipe lining. Torch cutting is not permitted. All pipe shall be cut at an angle of 90 deg. to the pipe centerline. Cutting at other angles to provide greater defections at the joints shall not be permitted.

3.1.7 Field welding or welding except by pipe manufacture shall not be permitted.

3.1.8 Unless otherwise approved or directed by the ENGINEER, pipe shall be laid with bell ends facing the direction of laying; and for lines on an appreciable slope, bells shall, at he direction of the ENGINEER, face upgrade.

3.1.9 No pipe shall be laid in water, or when the trench condition or the weather is unsuitable for such work, except by permission of the ENGINEER.

3.1.10 A continuous 16-gauge bare copper wire shall be installed with all pipe including service lines. The wire shall be laid along the pipe passing completely around the pipe at intervals not to exceed twenty (20) feet. The wire shall be looped around valves, saddles, curb stops and other appurtenances in such a manner that there is not interference with the operation of the appurtenances.

The wire shall be looped securely around all valve boxes and hydrants and shall be left exposed in all meter boxes to provide conductive, metal contacts for tracing water pipe.

Continuity and conductivity of the 16-gauge tracing wire shall be tested by the CONTRACTOR in the presence of the ENGINEER. Any section or sections not showing continuity and/or conductivity shall be corrected and retested by the CONTRACTOR. All costs of testing shall be borne by the CONTRACTOR.

3.1.11 During the pipe laying operation, deflections at joints or in the pipe itself shall not exceed the amounts recommended by the pipe manufacturer.

3.1.12 Ductile iron pipe shall be wrapped in polyethylene encasement in accordance with one of the approved procedures as outlines in ANSI/AWWA C105/A21.5 specification.

3.2 JOINTING FOR WATER LINES

3.2.1 <u>Jointing Mechanical Joint Pipe and Fittings</u>: Prior to jointing the pipe and/or fittings, the plain ends of the pipe and the bells of the pipe and fittings shall be

thoroughly cleaned using a soapy water and cloth, removing all foreign materials from the bells, especially the gasket seats.

The cast or malleable iron follower rings shall be placed on the plain end of the pipe or fittings, followed by the rubber gasket which has been thoroughly cleansed and lubricated with the soapy water.

The plain end of the pipe shall be placed in the bell, to which connections is to be made, and shouldered in back of the bell. The rubber gasket shall be advanced into the bell and seated in the gasket seat; the follower ring shall next be brought into contact with the rubber ring, and all bolts entered and nuts started. The pipe may then be given the maximum deflection recommended by the piper manufacturer.

Joints shall be made tight by advancing the nuts with a wrench 180 deg. apart until a tight joint is made.

The CONTRACTOR shall provide a "torque wrench" suitable for measuring tension on bolts for at least such a time as the workmen making the joints have gotten the "feel" of the required tension. At no time should handles longer than those supplied by the wrench manufacturer be permitted. The torque range shall be as follows:

5/8"	Bolts	45 - 60 ft. lbs.
3/4"	Bolts	75 - 90 ft. lbs.
1 "	Bolts	80 - 100 ft. lbs.
1 - 1/4"	Bolts	105 - 120 ft. lbs.

After the workmen have become accustomed to this torque, a socket wrench with a 10-inch handle may be used.

The rubber gasket and joint bolts of mechanical joint retainer glands shall be installed in accordance with above. Set screws shall be tightened evenly to approximately 65-foot pounds for larger diameter. Do not attempt to deflect joint after tightening set screws.

3.2.2 Jointing Push-On Joint Pipe and Fittings: Prior to jointing the pipe and/or fittings, the plain ends of the pipe and the bells of the pipe and fittings shall be thoroughly cleaned using a soapy water and cloth, removing all foreign material from the bells, especially the gasket seats. Any burrs or imperfections in that part of the plain end or bell which will be in contact with the gasket shall be removed.

The clean rubber gasket shall be inserted in the bell and a thin film of lubricant shall be applied to the inside surface of the gasket.

The cleaned plain end shall initially be entered in the bell straight.

The plain end shall be forced inside the gasket and bell until it strikes the end of the interior of the bell, after which the end of the pipe shall be moved sideways or up eight (8) inches to move it slightly away from home to allow for expansion and to provide flexibility to the completed line. The pipe may then be given the maximum deflection recommended by the pipe manufacturer.

Lubricants are normally supplied by the pipe manufacturer in sufficient quantities. No substitutes shall be made.

The CONTRACTOR shall furnish such jacks, or other devices as are necessary for forcing the pipe into the bell and gasket. Care shall be exercised to avoid damage to the pipe where the pushing device or machine part contacts the pipe. A wood block or suitable pad shall be placed between the pipe and that part of the pushing device which contacts the pipe.

All plain ends that enter a push-on bell shall be beveled at 30 deg. for a least 1/8-inch. All cut pieces or ends of pipe of other classifications shall be so beveled.

3.2.3 Installation of PVC Joints: Both bell and plain end of pipe shall be thoroughly cleaned before attempting to joint the pipe.

Place rubber gasket in bell if not delivered from supplier in place. The colored side of the gasket shall be to the outside.

Lubricate the plain end (do not lubricate the bell end) with approved lubricant and insert plain end into the bell until stop mark on plain end is
flush with the end of the bell. In the case of pipe which has two marks on the plain end, insert plain end into bell so that only one mark is visible.

When the pipe is cut, the plain ends must be beveled similar to the bevel on full lengths. After beveling, stop marks must be applied to the ends. Use the plain end of another piece of pipe or fitting to determine the location of the stop mark and mark the piece of pipe that has been cut.

Pipe shall not be exposed to sunlight for more than thirty (30) days. Any PVC pipe exposed to sunlight for more than thirty (30) days shall be removed from the construction site and shall not be used in this project.

The joints shall be inserted as far as possible on each side of valves that are inserted in the line.

3.3 Installation of Valves: Valves shall be jointed in accordance with the methods of jointing pipe as specified elsewhere herein. Valve stems shall

be plumb and there shall not be any obstructions which will prohibit the installation of valve boxes directly over the stem.

Concrete anchor collars shall be provided around an adjoining length of pipe for all valves 16-inches in diameter or larger and for smaller valves when specified on the Plans. Mechanical joint retainer glands shall be installed on all valves with mechanical joint ends 12-inches in diameter or larger when cast iron or ductile iron pipe is specified and for smaller valves when specified on the Plans. All valves installed in conjunction with PVC pipe shall be cradled in concrete with an adequate bearing area to prevent differential settlement between the valve and the pipe.

When the distance between the valve operating nut and the finished surface exceeds five (5) feet, a valve stem extension shall be provided. The stem shall be round steel bar stock at least 7/8-inch in diameter with a 2-inch square operating nut attached to the upper end and of length adequate to reach from the valve operating nut to a point within 18-inches to 12-inches of the finished surface. A box wrench made from steel 1/4-inch thick shall be welded to the lower end of the stem extension which will fit over the valve operating nut. The stem extension shall be attached to the valve operating nut by a 1/4-inch bolt which shall pass through the stem extension box and the valve operating nut. The hole for the 1/4-inch nut shall be 3/8-inch in diameter. A round center guide made from 3/16-inch or 1/4-inch steel plate shall be welded to the valve stem extension approximately six (6) inches from the upper end. The diameter of the quide shall be slightly smaller in diameter than the inside diameter of the valve box. Shop drawings shall be submitted to the ENGINEER for approval prior to installing stem extension pieces.

3.4 Installing Valve Boxes: Valve boxes shall be set vertical and concentric with the valve stem. Any valve box which is so moved from its original position as to prevent the application of the valve key shall be satisfactorily reset by the CONTRACTOR at his own expense. A concrete pad of the dimensions shown on the details of the plans shall be poured around all valve boxes.

3.5 Installing Fire Hydrants: Hydrants shall be thoroughly cleaned before setting, removing all dirt and foreign matter from the barrel and the bottom section up to the main valve.

The main valve shall be in the "closed" position and the waste outlet shall be free of any obstruction.

Hydrants shall be located a safe distance from driveways, roadways and narrow type sidewalks and in a manner to provide complete accessibility and they shall stand plumb with nozzles at proper elevation.

Unless otherwise directed, the large diameter nozzle shall be at right angles to the street, with no portion of the nozzle cap less than eighteen (18) inches from back of the curb.

The CONTRACTOR shall, if necessary, rotate the hydrant barrel or nozzle section at the joint to obtain the desired nozzle position as specified by the ENGINEER.

The bowl or bottom of the hydrant shall be supported firmly on the bottom and shall be well braced against unexcavated earth on the back side. Concrete will be used to block the hydrant. If considered necessary by the ENGINEER , the hydrant shall be tied to the branch pipe with suitable rods or clamps. These rods or clamps to be furnished by the CONTRACTOR without additional compensation.

A drainage bed shall be provided under and around the base of the hydrant of at least six (6) cubic feet in volume and extending at least six (6) inches above the drain outlet and shall consist of gravel or broken stone mixed with coarse sand thoroughly compacted. Under no circumstances shall the waste outlet on the hydrant be plugged by the concrete blocking; nor shall the outlet or the drainage bed be connected to a sanitary sewer.

Backfilling and tamping around hydrant barrels shall be continuous in operation.

After installation and before being tested and placed in service, fire hydrants shall be covered with a cloth or water resistant sack.

PART FOUR - MEASUREMENT AND PAYMENT

4.1 General: This section of the specifications covers the components considered to be a portion of each pay item as may or may not be listed in the Bid Proposal and is furnished to aid the CONTRACTOR in preparing his/her bid. Of necessity, the items described as components of the various items are discussed in a general manner only, describing the major pieces of equipment and/or materials. Any items and/or appurtenances not specifically mentioned shall be considered a portion of the bid item to which, in the opinion of the ENGINEER, its function is most directly related. Failure to list all items and/or appurtenances does not relieve the CONTRACTOR from furnishing all apparatus, devices, labor, or materials of whatever nature required for a complete and operating installation in accordance with the intent of the Drawings, approved Shop Drawings and these Specifications.

4.2 MEASUREMENT

4.2.1 Water Lines: The pipeline of the sizes indicated on the Plans, complete in place, will be measured for payment in linear feet along the ground surface above the pipe as installed. Measurement shall be through fittings, valves, and specials and no deduction in length shall be made for such appurtenances.

4.2.2 Gate Valves: Gate valves shall be measured by each at the sizes shown in the Bid Proposal and Plans.

4.2.3 Connection to Existing Water Line: Connections to existing water lines shall be measured by each at sizes and configurations shown in the Bid Proposal and Plans.

4.2.4 Air and Vacuum Valves: Measurement for air release and vacuum valve assemblies shall be by each installation at the locations and configurations shown in the Bid Proposal and Plans.

4.2.5 Fire Hydrant Assemblies: Measurement for fire hydrant assemblies shall be by each installation at the locations and configurations shown in the Bid Proposal and Plans.

4.3 PAYMENT

4.3.1 Water Lines: Installation of the water line will be paid for at the unit price per linear foot as provided in the Bid Proposal.

Payment of the unit price will be the total compensation for furnishing all labor, pipe, fittings, thrust blocking, tracing wire, tools, and incidentals and performing all work that is necessary for the installation in accordance with the Plans and provisions of the Specifications. No extra payment for testing and sterilization shall be made but it shall be considered subsidiary to unit price for "Water Line".

The installation of appurtenances and incidentals which are shown on the plans or described elsewhere in these specifications and for which there is no specific item included in the Bid Proposal shall be considered a part of the work to be performed and paid for at the contract price per linear foot of pipeline.

4.3.2 Gate Valves: This item shall include furnishing of all tools, equipment, materials, and labor necessary to install main line gate valves of the sizes indicated on the Plans. Payment shall be at the contract unit price shown in the Bid Proposal for the gate valve installation and shall include concrete cradle, valve boxes, valve box covers, retainer glands and all other related work and materials.

4.3.3 Connection to Existing Water Main: This item shall consist of furnishing all tools, equipment, materials, and labor, couplings, tapping sleeves, valves, fittings, and blocking and all other related work and materials necessary to connect to an existing water main according to the Plans and Specifications. Payment for connection to an existing water main, for the various sizes, shall be at the unit prices shown in the Bid Proposal for each connection.

4.3.4 Air and Vacuum Valves: This item shall include furnishing of all tools, equipment, materials, and labor necessary to install Air Release Vacuum Valve Assemblies of the sizes shown on the Plans and in accordance with the Specifications. Payment shall be at the unit prices shown in the Bid Proposal for each installation.

4.3.5 Fire Hydrant Assembly: This item shall include furnishing of all tools, equipment, materials, and labor necessary to install a Fire Hydrant Assembly as shown on the Plans and in accordance with the Specifications. A Fire Hydrant Assembly shall include, but not be limited to the hydrant, gate valve, lead piping, tee, restraining assemblies, blocking, gravel and all other related work and materials. Payment shall be at the unit prices shown in the Bid Proposal for each installation.