

TECHNICAL SPECIFICATIONS

ITEM 3

WATER SYSTEM

1. General: The Contractor shall be responsible for furnishing all materials and accomplishing all work necessary for the construction of new water lines in accordance with approved plans and in conformance with the following requirements. He shall also be responsible for the construction of service lines from the main to the meter box location behind the curb. The Contractor shall make all required connections to existing lines. All plans and specifications shall conform to the current Rules and Regulations for Public Water Systems of the Texas Department of Health and to these Specifications as they may be amended. Water lines shall not be located closer than nine (9) feet from sewer lines. Where water lines cross sewer lines, the water line shall cross over the sewer line, if possible. All work will be subject to inspection by an authorized representative of the City and no work will be accepted until all construction, testing, flushing, and disinfection has been completed in accordance with the applicable plans and these specifications and to the satisfaction of the City Engineer. Any work found not to be acceptable shall be removed and replaced at the Contractor's expense. The Contractor shall notify the City Engineer or City Manager prior to starting work and prior to covering any water lines in place.

2. Materials: Materials for water line construction shall conform to requirements specified below. All materials shall be class 150, or designed for 150 p.s.i. working pressure. All new water lines shall be a minimum of six (6) inches in diameter, except that smaller diameter lines may be installed in designated locations within the existing developed areas of the City for system rehabilitation or for interim supply augmentation.
 - A. Pipe: Pipe for lines four (4) inches to twelve (12) inches in diameter shall be Cast Iron or Polyvinyl Chloride (PVC). Lines over twelve (12) inches in diameter shall be Concrete Steel Cylinder type. Lines smaller than four (4) inches in diameter shall be PVC.
 - (1) Cast Iron Pipe shall be manufactured in accordance with Federal Specification WW-P-421b 1b or in accordance with AWWA C106 (ANSI- A21.6) or AWWA C108 (ANSI-A21.8) Specifications. All pipe shall be designated Class 150. All pipe shall have an inside mortar lining reduced to one-half (1/2) that stipulated in the American Standards Association Specifications for Cement Mortar Lining (ASA-A21.4- 1953). Outside coating shall conform to the current AWWA Specification C106 (ASA-A21.6). Cast iron pipe shall be approved by the Underwriter's Laboratory and shall be accepted by the State Fire Insurance Commission for use in water distribution systems without penalty. All pipe shall be new and made in the United States. All cast iron pipe shall be designed for five (5) feet of cover. Unless otherwise specified on the plans or in the Special Conditions, above ground joints shall be flanged, sub-surface joints shall be compression, and all specials shall be mechanical joint.
 - (a) Bell and Spigot: Bell and spigot shall comply with the current Federal Specification WW-P-421b as Type 11 bell and spigot.
 - (b) Mechanical Joint: Mechanical type joints for cast iron pipe and fittings shall comply in all respects with current American Standards Association Specification ASA-A21.11.
 - (c) Flanged Joint: Flanged joints for cast iron pipe and fittings shall comply with current American

Standards Association Specification ASA-B16.

- (2) Polyvinyl Chloride (PVC) Pipe for four (4) inch through twelve (12) inch size shall be rigid integral bell and spigot type conforming to the requirements of AWWA Standard C-900, "Polyvinyl Chloride (PVC) Pressure Pipe", for class 150 pipe, cast iron pipe O.D., with wall thickness of DR series 18. Pipe shall be suitable for use in a potable water system, and shall be approved by Underwriter's Laboratories for use in fire lines and water mains, and shall have the NSF Seal of Approval. The manufacturer shall furnish an Affidavit of Compliance to the effect that all materials meet the specification requirements. Joints must provide for contraction and expansion of the pipe. Bells shall be designed to be of equal or greater strength than the pipe. Rings and lubricants shall be of the type designed for water service.

Pipe shall meet all physical property requirements of Section 2.2.3 of AWWA Standard C-900. Standard laying lengths shall be twenty (20) feet, plus or minus one (1) inch, with a maximum of 15 (15) percent furnished in shorter lengths of not less than ten (10) feet each.

- (3) Concrete Pressure Pipe shall be pretensioned concrete steel cylinder pipe conforming to the requirements of AWWA Standard C303, and shall be furnished in nominal thirty-two (32) foot or thirty- six (36) foot lengths.

The manufacturer shall submit a complete experience record in the design and construction of the type of concrete pressure pipe involved. The manufacturer shall also provide an Affidavit of Compliance as described under Section 1.11 of AWWA Standard C303. Upon the award of the contract, the Contractor shall furnish the City with Shop Drawings, showing the pipe and fittings to be furnished and shall include a tabulated layout schedule with reference to the stationing on the contract drawings with plan and profile drawings. Such drawings shall be subject to the approval of the City Engineer, and fabrication of pipe and fittings shall not be commenced until such drawings have been approved. Such approval will not relieve the Contractor of any responsibility of providing pipe and/or fittings in accordance with the plans and specifications.

The pipe shall be designed for 150 psi working pressure and 225 psi working plus transient pressure.

Chlorine and/or test connections consisting of an installed corporation-stop shall be required when installing a gate valve in concrete pressure mains (one (1) on each side of the gate valve). These connections shall have a bushing of nylon or other approved nonconductor installed by the pipe manufacturer.

Pipe design for external loads shall be based on the following external loading conditions:

- (a) Earth Load: Five (5) foot depth of soil using 130 lbs/C.F.

- (b) Concentrated Loads:

Within pavement limits - 16,000 lbs.

Outside pavement limits - to accommodate Contractor's equipment, but not less than 8,000 lbs.

(c) Load Factor: 1.90 (Class B bedding)

(d) Impact Factor, Live Loads: 1.0

(e) Factor of Safety: 1.50

- (4) Plastic Pipe 3" and under shall meet the requirements for unplasticized Polyvinyl Chloride (PVC) pipe with integral thickened-wall and bells shall meet all requirements of ASTM D1784, ASTM D2241, and Commercial Standard CS256-63. Unless otherwise specified, the pipe shall be pressure rated at 160 psi with a standard dimension ratio (SDR) of 26. All pipe must meet requirements as set forth in Commercial Standard CS256-63, bearing the National Sanitation Foundation seal for potable water pipe. Provisions must be made for contraction and expansion at each joint, with a rubber ring and integral bell as part of each joint. Pipe and fitting must be assembled with a non-toxic lubricant. Pipe shall be made from an NSF-approved Type I, Grade I, PVC compound conforming to ASTM resin specification D1784. Clean, reworked material generated from the manufacturer's own pipe production may be used. All physical and chemical tests shall be method.

B. Fittings and Specials:

- (1) Fittings and specials for cast iron and PVC pipe shall be cast iron or ductile iron conforming to the requirements of AWWA Standards C110 and C111 for Class 150 service. Joints shall be integral bell and spigot, mechanical joint, or flanged joints as required by the pipe joint and all fittings shall be cement lined. Flanges shall be Class 125. All fittings shall be short body type.
- (2) Fittings and Specials for Concrete pressure pipe shall be provided as necessary for the concrete pressure pipe line and for connection to other types of pipe or fittings. Design of fittings shall conform to the requirements for the design of the pipe with which they and other specials are specified elsewhere in these specifications, but all special adapters necessary for connections to the concrete pressure pipe shall be provided by the concrete pressure pipe manufacturer and shall be shop fabricated.
- (3) Accessories: All bolts, nuts, glands, gaskets, and other accessories necessary for the complete installation shall be furnished with the pipe and fittings.

- C. Gate Valves two (2) inch thru twelve (12) inch valves shall conform to the requirements of AWWA Standard C500 for double disc type with parallel seats and all valves shall have a non-rising stem with a resilient wedge either Mueller, Clow, Waterous or M & H. Valves shall have mechanical joint ends except that valves used with flanged pipe shall have flanged ends, and end joints shall be specifically designed for the type of pipe or joint to which they will be connected. Valves shall turn counterclockwise to open. All valves shall be for vertical installation in horizontal lines. Operators shall be nut type for underground service and handwheels for above ground service.

Gate valves eighteen (18) inches and larger shall be equipped with spur gears. Gate valves sixteen (16) inches and larger, unless otherwise specified, shall be Mueller, M & H or Waterous.

Geared valves shall be equipped with cut-tooth steel spur gears without gear case where valves are to be installed in a vault or inside a pump station and not to be buried in the ground. Where valves are to be buried in the ground without a vault, cut-tooth spur steel gears having an enclosed gear case of the

"extended" type, oil or grease lubricated, shall be furnished. Removable cast iron plates shall be furnished on valves with gear cases of the extended type, installed on the valve to enclose and keep the packing gland and valve stem free from dirt. All above ground two (2) inch valves shall have bronze bodies with all working parts of bronze. They shall be of the double disc, parallel seat, internal wedging type and shall have screw ends. They shall open by turning to the LEFT. They shall be guaranteed for one hundred fifty (150) pounds per square inch working pressure.

- D. Cast Iron Valve Boxes and Covers: Cast iron valve boxes and covers shall be standard three (3) piece box and cover, consisting of base housing, extension hollow shaft and cover. The covers shall have the word "WATER" cast in raised letters in its upper surface on water mains and shall have no designation for other types of mains. Boxes furnished shall be adjustable unless shown otherwise on the plans and the extension hollow shaft shall be of sufficient diameter to admit readily standard valve wrench. Boxes shall be as manufactured by Mueller, Clow or equivalent and will be required for every subsurface gate valve unless otherwise specified.
- E. Fire Hydrants shall be either Mueller Centurion (A-423) or a Clow F2500 having a dry barrel and a six (6) inch inlet with a five and one-quarter (5 1/4) inch main valve opening, with one (1) pumper connection and two (2) hose nozzles, and shall conform to the requirements of AWWA Specification C502 except that the barrels shall have a frangible section at the ground level for break off upon impact. Hydrants shall open by turning counterclockwise. Barrels shall be for thirty-six (36) inch bury. Extensions shall be provided where necessary to attain the proper height setting of hydrants. The inlet shall be a mechanical joint.
- F. Service Lines: Materials for service lines from mains to the meter box shall be as specified below. Single services shall be a minimum of three-quarter (3/4) inch and double services a minimum of one (1) inch.
- (1) Copper tubing shall conform to ASTM Specification B88, Type K.
 - (2) Polybutylene tubing shall be SDR-9 Class 250, the SDR-11.5, as stated in the current specifications is of iron pipe size, where the SDR-9 is the same size as copper tubing.
 - (3) Fittings for either copper tubing or polybutylene tubing shall be brass conforming to ASTM B62. Couplings for copper tubing shall be compression type. Couplings for polybutylene tubing shall be compression type. All fittings shall have threads conforming to the following:

Coupling ends to be connected to iron pipe shall have thread dimensions conforming to Table 3 of ASA B2.1, American Standard Pipe Threads.

Coupling nut threads shall conform to the dimensions shown in Table 3 of AWWA Specifications C800.
 - (4) Corporation Cocks shall be Mueller H-15008 which is a CC thread x compression outlet.
 - (5) Curb or Meter Stops: For single service connections, curb stops shall be Mueller H-14258 compression inlet with lockwing head.

For double service connections, "U" branch connections shall be Mueller H-15363 with a

compression inlet. Two (2) curb stops, Mueller H-14265 shall be furnished and installed with lockwing head.

3. Excavation, Trenching, and Backfill, including pipe bedding, shall conform to the applicable provisions of Item 1, Trenching and Backfill, and to the applicable trenching and backfilling details. Walls of trenches shall be vertical to a minimum distance of twelve (12) inches above the top of the pipe. Minimum depth of cover shall be three (3) feet over the top of the pipe, except that minimum cover on top of service lines shall be at least eighteen (18) inches below the top of subgrade.
4. Pipe Handling: Handling of pipe during unloading, stockpiling, and distribution along the trench shall be done in such a manner that the pipe or coating is not damaged by handling equipment which may cause cuts or indentations in the pipe or coating. Slings shall be used to handle all pipe and fittings; no hooks will be permitted.

Plastic pipe shall be stored on flat surfaces to avoid deformation of the pipe. Particular care shall be exercised during cold weather to avoid severe impact which may damage the pipe. Care should be exercised at all times to prevent entrance of dirt and foreign matter into the pipe.

All pipe, fittings, valves, hydrants and accessories should be carefully lowered into the trench using suitable equipment in such manner as to prevent damage to pipe and accessory items. Pipe and accessories should never be dropped or dumped into the trench.

Pipe and accessories should be inspected for defects and cleanliness prior to lowering into the trench. Any defective, damaged or unsound material should be repaired or replaced and all foreign matter or dirt should be removed from the interior of the pipe and accessories before lowering into the trench.

Any unsound or damaged pipe, fittings, or specials shall be rejected and removed from the site unless, in the opinion of the Inspector, it is suitable for repair. Pipe or fittings approved for repair shall be repaired in accordance with the recommendations of the Inspector and the manufacturer of the pipe.

5. Installation: The pipe shall be kept clean during the laying operation and free of all dirt and trash and, at the close of each operating day, the open end of the pipe shall be effectively sealed against the entrance of all objects and, especially, water. Pipe shall be laid to the lines and grades shown on the plans or otherwise approved. Horizontal and vertical curves may be effected by offsetting of the pipe joints where the radius of the curve exceeds the minimum radius recommended by the manufacturer of the pipe. Where the curve radius is less than the acceptable minimum for offsetting the pipe joints, bends shall be installed.

All pipe and fittings shall be laid on specified bedding so as to be uniformly supported along its entire length. No "blocking up" of pipe or joints will be permitted. Bell holes to allow making the exterior joint shall be provided. Laying and jointing of pipe shall conform to the requirements of the following Manuals and Standards:

<u>Cast Iron Pipe</u> :	AWWA Standard C600
<u>PVC Pipe</u> :	ASTM Standard 2321
<u>Concrete Pressure Pipe</u> :	AWWA Manual M9

If the above listed publications are not available, the pipe shall be installed in accordance with the pipe manufacturer's published recommendations.

6. Setting Fittings: The Contractor shall furnish and install all fittings at the points shown on the drawings, and as directed. Before installing any fittings, care shall be taken to see that all foreign material is removed from the interior. Fittings shall be placed in the lines as shown on the plans or directed by the Engineer and shall be firmly supported and anchored in accordance with the recommendations of the manufacturer of the pipe.
7. Installation of Gate Valves: Valves shall be carefully handled and lowered into position by mechanical equipment in such a manner as to prevent damage to any part of the valve. The valve shall be placed in the proper position and held securely until all connections have been made.

Where valves are to be placed in a concrete structure the floor shall be completed before installing the valve. The valve shall be securely blocked so that its weight is carried by the floor rather than being supported by the connected piping.

Valves sixteen (16) inches and larger, which are not housed in structures shall be supported on concrete bases as detailed on the plans. Valves fourteen (14) inches and smaller, not housed in structures shall be supported on the same material as that supporting the connecting pipe. An adjustable cast iron valve box and cover shall be provided for all buried valves fourteen (14) inches and smaller, and all sixteen (16) inch valves installed in streets (including bypass valves), with stem extension when depth exceeds three (3) feet. The valve shall be set with the stem in a truly vertical position with the box correctly centered over the operating nut.

When the valve box is in position and the top of the box adjusted to the proper elevation, select backfill material shall be firmly tamped around the outside.

8. Setting Fire Hydrants: The hydrant shall set truly vertical and be securely braced and blocked with concrete. It shall be set on a block of concrete at least one (1) foot square and six (6) inches thick placed on well compacted or undisturbed soil surrounded by a minimum of seven (7) cu. ft. of clean gravel or stone to permit free draining of the hydrant.

The six (6) inch fire hydrant lead shall be of such length as is necessary to reach from the main to the hydrant location, and at such depth as to permit the pipe being installed in a horizontal position, and the barrel of the fire hydrant being in a vertical position. The bury depth may vary, and care must be taken to select and install the proper length of fire hydrant extension as required.

A six (6) inch gate valve shall be installed in the six (6) inch hydrant lead between the fire hydrant and the main where shown on the plans.

After installation is complete, the Contractor shall apply two (2) coats of bright red machinery enamel, Pittsburg or approved equal.

9. Installation of Three Inch (3) and Smaller PVC Lines: Fittings for two (2) inch and three (3) inch PVC pipe shall be PVC of the same pressure class. Gate valves shall be cast iron for two (2) inch and three (3) inch diameter pipe and gate valves under two (2) inch shall be bronze body, as hereinbefore specified. All joints shall be compression type. Pipe ends shall be lubricated in accordance with the manufacturer's recommendation and pushed in to the proper depth as indicated by the reference mark on the pipe. Pipe may

be jointed in the trench or above ground prior to placing in the trench. Bedding shall be used where rock is encountered in the trench or when directed by the Engineer. Pipe layed in earth trenches without rock need not have bedding if the backfill material is free of rock. Pipe shall be "snaked" in the trench when temperatures exceed seventy (70) degrees F to allow for contraction due to cooling, and the pipe should preferably be filled with water before backfilling.

10. Sewer Line Crossings: Whenever sanitary sewer mains, laterals or service lines are encountered by trenching operations, the sewer pipe shall be placed with one eighteen (18) inch joint of cast iron pipe centered in the trench. The cast iron pipe shall have solid bearing on undisturbed earth, at least eighteen (18) inches back from the face of the trench. The jointing and connection of the cast iron pipe to clay or concrete pipe shall be done in accordance with City standards. Upon completion of the joints they shall be completely surrounded with thoroughly compacted moist backfill.
11. Concrete Blocking and Cradle: Concrete blocking (Class "E" Concrete) shall be placed at bends, tees, crosses and plugs in the pipe lines. The concrete blocking shall be placed so as to rest against firm, undisturbed trench walls, normal to the thrust. The supporting area for each block shall be at least as great as that indicated on the plans an/or standard details and shall be sufficient to withstand the thrust, including water hammer which may develop. Each block shall rest on a firm, undisturbed foundation or trench bottom. When tie downs are required, concrete shall be Class "A" or "B" and constructed as detailed and/or noted on the plans. Concrete cradle shall be Class "E" concrete and shall be installed where shown on the plans in accordance with the standard details.
12. Pressure Testing: All new water mains shall be tested by the Contractor with a hydraulic test pressure of maximum of one hundred fifty (150) pounds per square inch. The pressure test shall be maintained for a continuous period of not less than four (4) hours on each section of the pipeline under test. All pressure testing will be monitored by the City Engineer prior to acceptance.

The Contractor shall furnish adequate and satisfactory equipment and supplies necessary to make such hydrostatic tests.

Materials and labor for the installation of corporation cocks in cast iron mains for this purpose will be furnished by the Contractor. The Contractor shall be responsible for all excavation, etc., in preparation for installation of taps.

The section of line to be tested shall be gradually filled with water, carefully expelling the air, and the specified pressure applied. The City will furnish water required for the testing at its nearest City line. All air shall be expelled from the pipe before applying the required test pressure.

All exposed joints shall be examined during the pressure test. All pipe, fittings and valves shall be examined while the test is in progress, and any items found to be defective shall be removed and replaced by the Contractor and retested after repairs are completed.

In order to determine the quantity of water lost through leakage in a section of pipe under the required test pressure the Contractor will be required to measure all water used in the pressure test through an approved meter. The maximum leakage permitted on the basis of one hundred fifty (150) pounds per square inch pressure shall not exceed the amounts indicated below for each type of pipe per inch of pipe diameter per mile of pipe in twenty-four (24) hours:

Cast Iron Pipe: 25 Gallons

PVC Pipe: 25 Gallons

Concrete Pressure Pipe: 25 Gallons

The Contractor shall correct defects and bring the leakage within the specified limits before the contract is accepted by the City.

Permanent pavement shall not be placed over any pipe until all leakage tests on the section of pipe line involved have been completed.

The cost of testing and finding and repairing the leaks, and retesting, if necessary, shall be at the expense of the Contractor.

13. Chlorination of Water Mains: When the entire pipe line, or selected sections thereof, have been completed, tested and are ready for turning over to the Owner for use, the line or section shall be disinfected according to the following procedure:

- A. The line shall be flushed out and filled with water from a City main.
- B. Chlorine or HTH shall be injected at one end of the line, and water released from the opposite end until chlorine is present at the discharge end in such quantity to indicate a residual of fifty (50) p.p.m.. All valves shall then be closed, and the solution shall remain in the line for at least twenty-four (24) hours.
- C. After twenty-four (24) hours the solution shall be discharged from the line and replaced by water direct from a City main.
- D. A water sample shall be taken from a suitable tap (not through a fire hydrant) under the supervision of the City and submitted to an Independent Laboratory or to the Texas Department of Health Laboratory for analysis. If the tests show a satisfactory quality of water, the line may be placed in service. If the sample shows an unsatisfactory quality of water, the process of disinfection shall be repeated until a satisfactory sample is obtained.
- E. Unless other wise specified or approved, the Contractor will make all necessary taps into pipe to accomplish chlorination of a new line.

14. Installation of Service Lines: Service lines shall be of copper or polybutylene plastic pipe as hereinbefore specified. Connections to water mains shall be made by tapping for cast iron pipe, and by the use of Mueller galvanized or cadmium coated Smith-Blair #313 (formerly Rockwell) or Ford F202 service saddle.

Corporation stops shall be installed in all taps or service saddles with the lines connected to the corporation stop. Service lines shall be installed a minimum of eighteen (18) inches below subgrade without sharp bends or changes of direction. Particular care shall be taken to avoid kinking or excessive bending of either copper or plastic pipe during installation and the pipe shall be laid from side to side in the trench to provide for expansion and contraction. Lines shall extend to approximately two (2) feet in back of and one (1) foot below the top of the back face of the curb. Curb stops, meter couplings, and "U" branch connections shall be provided on the end of the line for future connection to the meter. Service lines in earth trenches without

rock will not require bedding. Where trenches are partially or entirely in rock, or where the backfill material contains rock, bedding a minimum of four (4) inches under and over the pipe shall be required. The curb shall be marked by an imprinted letter "W", three (3) inches in height, at the point where the service pipe passes under the curb.

Pressure testing and sterilization of service lines is not required, but prior to backfilling, the lines shall be filled under normal working pressure and observed for leaks. Backfill will not be placed over pipe until approved by the City Inspector.

When tapping into the City water main the tapping sleeve shall be a stainless steel wrap-around, either the Smith-Blair #663 (formerly Rockwell) or the Romac SST.

The Contractor shall also furnish the City with the extracated piece of pipe from the tap known as the coupon.

15. Clean-Up: Upon completion of the installation of the water lines, distribution systems and appurtenances, all debris and surplus materials resulting from the work shall be removed.