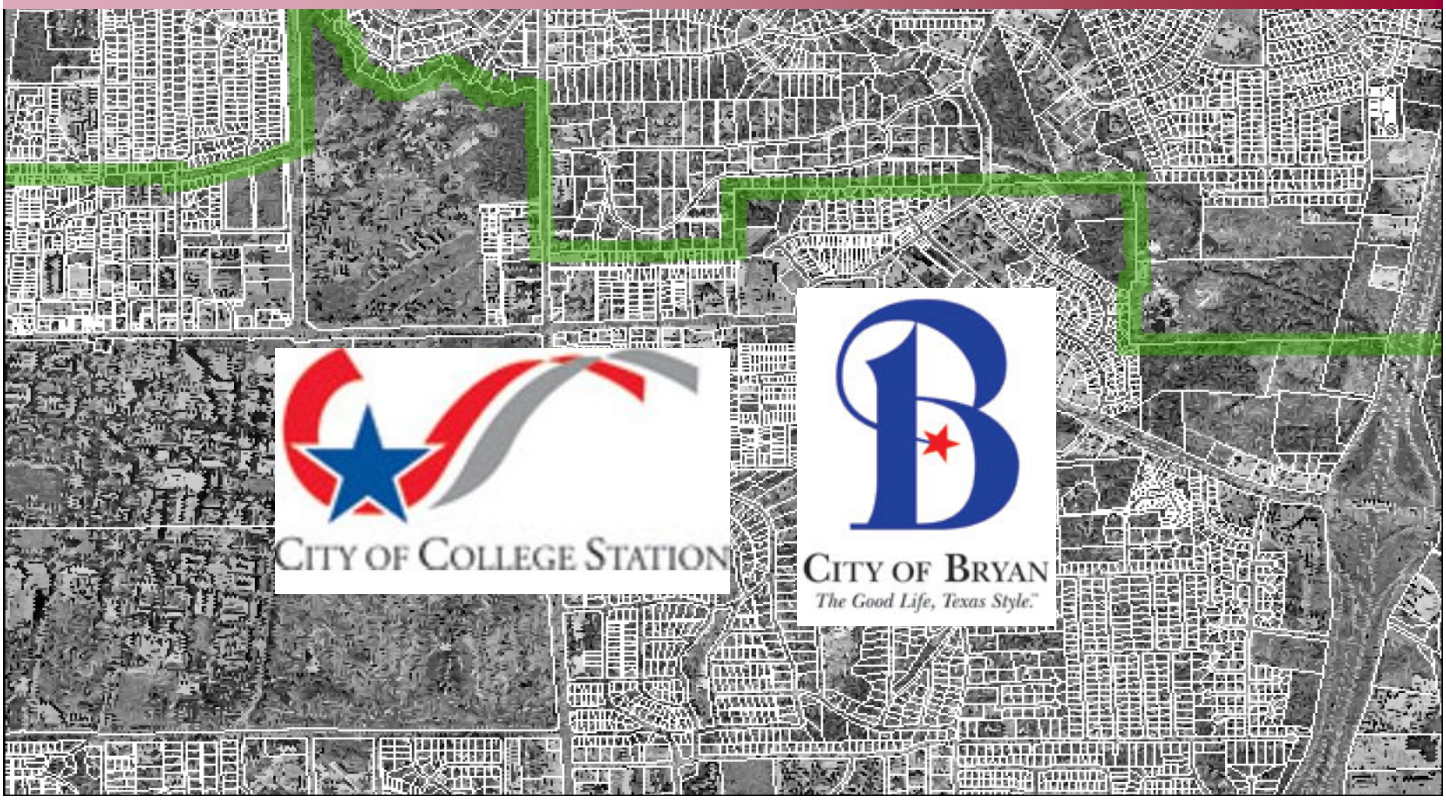
B/CS Unified Technical Specifications

Water 2012



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WATER:

SECTION 33 11 13.1

WATER MAIN CONSTRUCTION

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 – GENERAL

1.1 DESCRIPTION

A. This item shall govern the construction of water mains including trenching, backfilling, pipe-laying, coupling, testing, the setting of fittings, valves and valve boxes, fire hydrants, appurtenances and wet connections. All work is to be done in accordance with the plans and specifications and paid for in accordance with the schedule of prices submitted in the Proposal.

1.2 RELATED ITEMS

See:
SECTION 31 78 00 - PIPE BORING, JACKING, & TUNNELING
SECTION 03 30 01 - CONCRETE BLOCKING OR ANCHORAGE
SECTION 31 23 33 - EXCAVATING, TRENCHING, & BACKFILL
SECTION 33 05 01 - PVC PIPE & FITTINGS
SECTION 33 05 02 - DUCTILE IRON PIPE
SECTION 33 12 16 - VALVES
SECTION 33 12 19 - FIRE HYDRANTS
SECTION 33 12 13 - WATER SERVICES

1.3 MEASUREMENT AND PAYMENT

A. PIPE: Payments will be made at the price bid per foot for furnishing and installing pipe, which bid price will include all costs for the complete pipe installation including trenching, and backfill, embedment, compaction or tamping, sterilization, testing, final cleanup, and all other work not otherwise provided for in bid proposal. Pipe will be measured (by horizontal distance) from center of fitting to center of fitting, or end of pipe without deduction for the length of intermediate fittings or valves.

B. FITTINGS: Payment will be made at the unit price bid per each for furnishing and installing fittings and joint accessories. Fittings will be measured per each.

C. THRUST BLOCKING: Thrust blocking shall not be a measured item.

D. SERVICES: Services shall be measured per each. Payment for each service will include the furnishing and installing pipe, which bid price will include all costs for the complete pipe installation, including line fittings, trenching, and backfill, embedment, compaction or tamping, sterilization, testing, final cleanup, and all other work not otherwise provided for in bid proposal. See Detail or SECTION 33 12 13 – WATER SERVICES for supplementary information.

1.3 SUBMITTALS

All submittal requirements are listed with the material specifications

PART 2 – PRODUCTS

2.1 TESTING REQUIREMENTS

See: SECTION 33 13 10 - HYDROSTATIC TESTING (Used for Waterlines & Sanitary Sewer Force Mains)
SECTION 33 13 00 - DISINFECTION OF WATERLINES

PART 3 – EXECUTION

3.1 GENERAL

Construction methods for each material are specified in the material specifications.

A. MINIMUM COVER: The minimum cover for water pipe shall be four feet (4') as measured from the outside top of the pipe vertically to finished ground or pavement surface elevation. The maximum cover shall be 5 feet (5').

END OF SECTION

SECTION 33 12 13

WATER SERVICES

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the manufacture, construction, and installation of water services for ordinary waterworks service.

1.2 MEASUREMENT AND PAYMENT

A. Services shall be categorized as "long" if over 15-feet in length or "short" if 15-feet or shorter and measured as "EACH" or as provided in the Bid Proposal Form.

B. Payment will be made at the unit price bid per each for furnishing and installing services. This unit bid price will include all costs for the complete service installation, including all appurtenances, bedding, marking, testing, and disinfection.

1.3 SUBMITTALS

A. Submit manufacturer's data on materials furnished, indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Submit manufacturer's "Certificate of Compliance", stating that the materials furnished comply with this specification.

PART 2 – PRODUCTS

2.1 MATERIALS

All materials shall be as shown on the details. Service saddles for PVC and Ductile Iron shall be Smith Blair No. 317 stainless steel, Ford S70/S90 hinged, or Cambridge 800 series. All standard service lines shall be Type 'K' Copper. Tapped tee connection shall be ductile iron C153 MJ fitting.

The components for service connections shall be as listed in the following table.

Description	1-inch service	1.5-inch service	2-inch service
Corporation Stops	FB-1000-4*	FB-1000-6*	FB-1000-7*
Ball Straight Stops	B11-444-W	B11-666-W	B11-777-W
Angle Ball Curb Stops (for City of Bryan only)	BA13-444-W*	BA11-666-W	BA11-777-W
Angle Ball Curb Stops (for City of College Station only)	BA43-444W	FV43-666W	FV43-777W

Wye for double service to be Y44-264*
Part numbers listed are Ford part numbers.
*City of Bryan requires Quick Grip fittings (Q); City of College Station requires Pack Joint fittings

Service Saddles

Description	Bryan	COCS
Smith Blair 317 SS	Approved	
Cambridge 800 Series		Approved
Ford S70/S90		Approved

PART 3 – EXECUTION

3.1 GENERAL

A. INSTALLATION

Information supplied by the manufacturers on any and all appurtenances should be reviewed in detail by the Contractor before installation of the service. At the job site, prior to installation, the material should be visually inspected and any foreign material in the interior portion of the service should be removed. A detailed inspection of the service should be performed prior to installation.

Service connections shall be tapped tees in curved sections of pipe.

B. The services should be bedded in a fashion similar to bedding main lines as shown on the details.

END OF SECTION

SECTION 33 12 16

MAIN LINE VALVES

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the manufacture, construction, and installation of waterline valves for ordinary waterworks service.

1.2 MEASUREMENT AND PAYMENT

A. GATE VALVES

Gate valves will be measured by the each.

Payment will be made at the unit price bid per each for furnishing and installing gate valves, which bid price will include all costs for the complete gate valve installation, including extension stems, valve boxes, concrete blocking, testing, and disinfection.

B. APPURTENANCES

Operator extensions, valve boxes, brass plug valves, manholes, and concrete blocking will not be measured items.

1.3 SUBMITTALS

A. Submit manufacturer's data on materials furnished, indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Submit manufacturer's "Certificate of Compliance", stating that the materials furnished comply with this specification.

1.4 INSPECTION, STORAGE, AND HANDLING

A. All valves should be unloaded carefully. The valve should be carefully lowered from the truck to the ground, not dropped. In the case of larger valves, fork trucks or slings around the body of the valve or under the skids should be used for unloading. Only hoists and slings with adequate load capacity to handle the weight of the valve or valves should be used. Do not hook hoists into or fasten chains around bypasses, yokes, gearing, motors, cylinders, or handwheels.

B. Valves should be inspected at the time of receipt for damage in shipment. The initial inspection should verify compliance with specifications, direction of opening, size and shape of operating nut, number or turns, and type of end connections. A visual inspection of gate rings and body rings should be performed to detect any damage in shipment or scoring of the seating surfaces. Inspection personnel should look for bent stems, broken handwheels, cracked parts, missing parts and accessories, and any other evidence of mishandling during shipment. The valve should be cycled through one complete opening-and-closing cycle. All valves sixteen (16") inches and larger should be operated through one full operating cycle in the position in which they are to be installed.

C. Valves should be stored in the fully closed position to prevent entry of foreign material that could cause damage to the seating surfaces. Whenever practical, valves should be stored indoors. If outside storage is required, means should be provided to protect the operating mechanisms, such as gears, motor operators, and cylinders, from the weather and foreign materials. If valves may be subject to freezing temperatures, remove water from the valve interior and close the gates tightly before storage. Valves in outside storage in cold climates should be stored with the discs in a vertical position; if the discs are in a horizontal flat position, rain water can accumulate on top of the top disc, seep into the valve body cavity, freeze, and crack the casting. Any valves damaged by weather will not be installed.

PART 2 – PRODUCTS

2.1 MATERIALS

A. APPLICABLE STANDARDS

1. AWWA – C110, C111
2. ASTM – A48, C33, C150 and C478

B. GATE VALVES

All gate valves up to and including thirty (30") inch shall conform to the current AWWA C515 standard. All valves shall be ductile iron body, resilient seat nonrising stem, internal wedging type and new. All gate valves shall have a square nut operated valve turning clockwise to close. Brass nut is not allowed. Valves shall have a working pressure rating of 250 psi.

1. Resilient-Seated Gate Valves per AWWA C515

a.) *General*

All valves up to and including thirty (30") inch shall have a bronze stem, resilient-seated disc, drip tight shutoff. Valves shall be manufactured by American Flow Control Series 2500 or Clow Model No. 2638 and be "Resilient Seated" (Powder Coated).

b.) *Gates, Rings and Disc*

All gates shall be cast-iron with internally reinforced, molded rubber disc seat rings. All gate valves shall be manufactured with a modified wedge disc with steel reinforced, natural rubber disc seat ring. Disc shall slide on a vertical, machined guide surface and shall seat on a sloped, machined seating surface. Valves shall be tested for leakage per AWWA C515, Section 6.1.6.

c.) Gate valves twelve (12") inches or smaller will be installed seated on a minimum of one (1) 12"x12"x 4" solid concrete blocks. Valves larger than 12" will be seated by a poured-in-place concrete saddle. The size of this saddle is as shown on the plans.

2. Stuffing Boxes

All valves up to and including sixteen (16") inches shall be equipped with double O-rings, provided arrangement is made for replacement under pressure of the upper O-ring when the valve is fully open. All geared valves will be equipped with conventional packing in the main stuffing box. Valves shall be installed in a vertical position. Stuffing box and bonnet bolts and nuts shall be 304 stainless steel.

3. Operating Nuts

   All valves shall be square nut operated. All valves shall open by turning to the left (counter clockwise). Operator nuts shall be two (2") inch square.

4. Miscellaneous Requirements

   a.) All exposed bolts, nuts, etc., for valves to be buried, shall be stainless steel. Cadmium plated bolts, nuts, etc., will not be accepted.

   b.) A valve nut extension will be installed to maintain 4' bury to operating nut when the operating nut is located 5' or more below finished grade after valve installation.

D. VALVE ENDS

1. Valves shall have mechanical joint ends. Mechanical joint ends shall conform to AWWA C111. Flanged ends shall conform to ASA B16.1, Class 125 lb. (unless otherwise noted).
2. Bolts and nuts for mechanical joints will be of high-strength low-alloy corrosion resistant steel and conform to AWWA C111. All mechanical joint glands will be ductile iron.
3. Bolts and nuts for flanged ends buried in the ground shall be Type 304 stainless steel.

E. OPERATOR EXTENSION SHAFTS

Operator extension shafts are required on all valves when the operating nut is over five (5') feet below finished grade. Extension shaft is to bring the operating nut to within four (4') to five (5') feet of the top of the valve box. Extension shaft shall have a centering collar placed directly below operating nut and shall be bolted to valve operating nut with stainless steel set screw.

F. VALVE BOXES

A valve box shall be furnished and installed over each underground valve. The boxes shall be cast iron of the two-piece screw type, with a shaft diameter of not less than five and one-fourth inches (5-1/4") and shall have the word "WATER" stamped on the lid. Provide extension stem for all buried valves terminating in a standard 2-inch square AWWA nut within four (4') to five (5') feet of valve box cover. All parts of the valve box, base and cover shall be coated with hot bituminous varnish. The box shall be furnished complete with cast iron cover and yoke to fit over the valve body. Concrete valve box collars (24"x24"x6") shall be installed with each gate valve. Valve boxes are to be installed plumb and adjusted to their proper grade by the Contractor.

G. BRASS PLUG VALVES

One-half (1/2") inch through two (2") inch plug valves, when shown on the plans or required, shall be of all brass construction, and warranted for a water working pressure of 200 pounds per square inch. Brass plug valves smaller than two (2") inches shall be Mueller Oriseal, or pre-approved equal. Two (2") inch brass plug valves shall be Ford B11-777W or Mueller H-10284, or pre-approved equal.

H. CONCRETE

Cement shall conform to ASTM C150, Type 1. Aggregates shall conform to ASTM C33. Twenty-eight (28) day compressive strength shall equal or exceed 3,000 psi.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Any and all instruction manuals supplied by the manufacturers should be reviewed in detail before installation of the valve. At the job site, prior to installation, the valve should be visually inspected and any foreign material in the interior portion of the valve should be removed. A detailed inspection of the valve should be performed prior to installation.

1. All bolts should be protected to prevent corrosion, either with a suitable paint or by polyethylene wrapping.

2. During installation, there exists the possibility of foreign materials inadvertently entering the valve. Valves should be installed in the closed position. The valve shall be seated on a minimum of one (1) 12”x12”x 4” solid concrete blocks. Valves larger than 12” will be seated by a poured-in-place concrete saddle in the trench to prevent settling and excessive strain on the connection to the pipe. Size of this saddle shall be shown on the plans.

3. A valve box or vault should be provided for each valve used in a buried service application. The valve box should be installed so as not to transmit shock or stress to the valve. The valve box should be centered over the operating nut of the valve, with the box cover flush with the surface of the finished area, or such other level as directed by the City. Valve boxes should be of such a design that a traffic load on the top of the box is not transmitted to the valve.

4. Valves buried in unusually deep trenches shall have extension stems for operating the valve.

B. Valves installed above ground or in plant piping systems should be supported in such a way as to minimize bending of the valve end connections as a result of pipe loading.

C. After installation and before pressurization of the valve, all pressure-containing bolting (bonnet, seal plate, bypass, and end connections) should be inspected for adequate tightness to prevent leakage. In addition, an inspection should be made for adequate tightness to prevent leakage. In addition, an inspection should be made for adequate tightness of all tapped and plug openings to the valve interior. Proper inspection at this time will minimize the possibility of leaks after pressurization of the piping system.

D. In order to prevent time lost searching for leaks, it is recommended that valve excavations not be backfilled until after pressure tests have been made.

1. If valves are used to isolate test section, the test pressures should not exceed twice the rated working pressure of the valve. After the test, steps should be taken to relieve any trapped pressure in the body of the valve. The valve should not be operated in either the opening or closing direction at differential pressures above the rated working pressures.

E. Upon completion of the installation, valve location, size, make, type, date of installation, and other information deemed pertinent should be entered on permanent records and given to the Engineer.

F. Valves should not be installed in applications or for service other than those recommended by the manufacturer.

1. Valves should not be installed in lines where service pressure will exceed the rated working pressure of the valve.

2. Mainline valves shall not be used for throttling service, unless the design is specifically recommended for that purpose or approved in advance by the manufacturer and Engineer.

3. Valves should not be used in applications for water distribution that is exposed to subfreezing temperatures unless sufficient flow is maintained through the gate valve to prevent freezing, or some other type of protection is provided to prevent freezing.

4. Valves should not be installed at the dead end of a pipeline without proper and adequate restraint to support the valve and prevent it from blowing off the end of the line. No concrete shall be used on the valve for blocking.

5. To prevent damage to the valve, gate valves, up to and including sixteen inches (16") in diameter shall not be operated with input torques greater than 300 ft-lbs. .

END OF SECTION

SECTION 33 12 19

FIRE HYDRANTS

(Sentences and/or paragraphs that are double underlined indicate revisions that were made from the 2009 specification.)

PART 1 - GENERAL

1.1 DESCRIPTION

This section describes the manufacture, construction, and installation of fire hydrants.

1.2 MEASUREMENT AND PAYMENT

A. FIRE HYDRANTS

Fire hydrants will be measured by the each as shown on the plans.

Payment will be made at the unit price bid per each for furnishing and installing fire hydrants, which bid price will include all costs for the fire hydrant installation, (excluding TEE), hydrant piping and fittings, hydrant gate valve, extension stems, valve boxes, concrete blocking, testing, disinfection, and all other work not otherwise provided for in the Proposal. The main line fitting is not included in the cost of the fire hydrant.

B. APPURTENANCES

Operation extensions, valve boxes, gate valves, mainline fittings, hydrant piping and fittings, anchor couplings, and concrete blocking will not be measured items and shall be considered subsidiary.

1.3 SUBMITTALS

A. Submit manufacturer's data on fire hydrants to be furnished indicating compliance with the specifications especially regarding dimensions, materials of construction, and nozzle threads.

B. Submit manufacturer's "Certificate of Compliance" stating that the materials furnished comply with the specifications.

C. Upon request, flow data, indicating friction loss in PSI at the flow of 1,000 GPM from the pumper nozzle, such friction loss must not exceed 3 PSI. ISO 9001 certification.

PART 2 – PRODUCTS

2.1 APPLICABLE STANDARDS

A. AWWA –C110, C111, C502, and C600

B. ASTM – C33 and C105

2.2 GENERAL

A. All fire hydrants furnished shall conform to the requirements and test of AWWA C502-94 Standard for Dry Barrel Fire Hydrant or latest version thereof, as they pertain to the design, component materials, construction and manufacture, except as modified or supplemented hereinafter. Fire hydrants shall have a published warranty against defects in material or

workmanship for a period of ten (10) years from date of manufacture. Acceptable fire hydrants shall be American Flow Control 5-1/4" B-84-B and Clow Medallion.

1. Pressure rating -- working pressure shall be 250 psig tested to 500 psig hydrostatic pressure.
2. Flow -- friction loss shall not exceed 3.0 psig at a flow of 1000 gpm through the pumper nozzle connection when tested as prescribed in AWWA C-502 latest revision. This test must be conducted by an independent laboratory in their facility and attested to by a Professional Engineer. Documentation must accompany all requests for hydrant approval.
3. Drain valve -- must drain the barrel when the hydrant is closed, and seal shut when hydrant is opened.
4. Seat ring and Drain ring (show bushing) – must be bronze (ASTM B-62), shall work in conjunction to form an all bronze drain way, and shall have no less than two (2) openings. If they are in a cast iron shoe, they must be bronze lined and the bronze seat ring must thread into bronze drain ring (or shoe bushing) providing bronze to bronze connection. Seat rings must be "O" rings. The 6" shoe connection must be specified (flanged, A/C, M.J, etc.) having ample blocking for sturdy setting. A minimum of eight (8) bolts and nuts is required to fasten the shoe to the lower barrel.
5. Main valve – compression type closing with the pressure and must be not less than 5-1/4" in diameter. Composition of the main valve must be molded rubber or neoprene, having a durometer hardness of 95 (+) (-) 5 and must be not less than 1" thick.
6. Outlet – "Three-way" having two (2) 2-1/2" hose nozzles and one (1) 4-1/2" I.D. pumper nozzle; all National Standard Hose Coupling Thread. All nozzles shall be bronze and thread counter clockwise into the nozzle section with "O" ring pressure seals and held in place with an acceptable locking device
7. Hydrant barrel casting – inside diameter of the hydrant barrel shall not be less than six and one-eighth inches (6-1/8").
8. Operating nut – Non-rising, pentagonal in shape, measuring 1-1/2" from point to flat at base of nut; bronze.
9. Hold-down nut – Shall incorporate an integral resilient weather seal and open counter clockwise.
10. Lubrication chamber - Must be provided with sealed top and bottom "O" rings, filled with lubricant which shall be either oil or grease, designed with thrust collar and threaded operating parts that are automatically lubricated each time the hydrant is cycled. There must not be less than two (2) "O" rings separating the lubrications reservoir from the waterway and that portion of the stem contracting these "O" rings shall be sleeved with bronze. An anti-friction device must be in place above the trust collar to further minimize operating torque.
11. Hydrant bonnet – must be attached to the upper barrel by not less than four (4) bolts and nuts, with an inserted flat rubber gasket as a pressure sea.
12. Direction to open – counter clockwise.
13. Operating stem – must be two-piece, not less than 1-1/4" diameter or 1" x 1" square (excluding threaded or machined areas) and must be connected by a breakable stem coupling near the ground line flange. Screws, pins, bolts or fasteners used in conjuction with the stem coupling must be stainless steel.
14. Exterior paint – red machinery enamel.

B. ADDITIONAL REQUIREMENTS

1. Breakable Type Construction

Hydrants shall be traffic-model type having upper and lower barrels joined approximately two inches (2") above the ground line by a separated and breakable "swivel" flange providing 360 degree rotation of the upper barrel for proper nozzle facing. This flange must employ not less than eight (8) bolts.

2. Provisions for Extension

All hydrants shall be capable of being extended to accommodate future grade changes without excavation. Compression type hydrants that close with the flow shall have breakable type stem coupling installed at the ground line flange. Extension of this type hydrant shall be made by adding at the ground line flange, a new coupling and stem section equal to the length of the extension. Stem extensions made by adding a new section of stem to the threaded section of the stem at the top of the hydrant will not be accepted. Only one extension is allowed.

3. Bury Length

Furnish hydrants for a four (4') foot bury unless the water line grades shown on the plans indicate a deeper bury is required.

4. Operating Stems

Operating stems whose threads are located in the barrel or waterway shall be of manganese bronze, Everdur, or other high quality non-corrodible metal, and all working parts in the waterway shall be bronze to bronze.

Operating stems whose threads are not located in the barrel or waterway may be made of high-grade bronze, genuine wrought iron, or steel, and stem nuts shall be bronze. Iron or steel stems shall have a bronze, stainless steel, or other non-corrodible metal, sleeve where passing through "O"-rings. Operating threads must be sealed against contact with the water at all times regardless of open or closed position of the main valve.

The operating mechanism, safety stem coupling and main valve assembly shall be capable of withstanding 200 ft-lbs of torque against the fully open or closed positions, with no damage to the components. Downward stem travel shall be limited in the bottom of the hydrant by a one-piece lower valve plate that bottoms out in the hydrant shoe. Travel stops located in the bonnet or upper valve plate is unacceptable. The interior and the exterior of the hydrant shoe shall be fully coated with not less than 8 mils of fusion bonded epoxy.

5. Main Valve Seats

Main valve seats on compression type hydrants closing with the flow shall be of such design that incorrect positioning is impossible and that the threads will be adequately guided into position. Arrangements shall also be made to hold the main valve gasket in place during assembly. The main seat shall be made of bronze and threaded into a heavy bronze bushing in the hydrant base.

6. Seat and Drain Ring

The bronze seat shall thread directly into a bronze drain ring. This will assure easy removal of the main valve seat through the top of the hydrant shoe and all pressure seals must be "O"-rings.

7. Hydrant Heads

   The hydrant shall be constructed so that the nozzles may be faced in any desired direction.

8. Mating Surfaces

   All mating surfaces, such as bonnet-to-nozzle section, nozzle section-to-lower barrel, lower barrel-to-shoe, must utilize rubber gaskets for sealing and must be held in place by zinc-plated bolts and nuts. Other methods, such as snap rings, etc., will not be accepted.

9. Manufacturer Experience Record

   No hydrant will be considered which has not been regularly manufactured and in successful continuous use for at least 10 years.

C. ACCESSORIES REQUIRED

1. Full face ground line flange gaskets.
2. Nozzle cap gaskets
3. Drain valve and outlet
4. Cap nuts to seal the bottom end of stem threads against contact with water
5. Harnessing lugs (Required only when shown on the plans.)

2.2 TESTING REQUIREMENTS

See SECTION 33 13 10 – HYDROSTATIC TESTING and SECTION 33 13 00 – DISINFECTION OF WATERLINES.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

A. Fire hydrant leads 18’ or shorter will be restrained the entire length. Fire hydrant leads shall require a separate valve for the fire hydrant assembly. If main line valve is within 50’ of fire hydrant, then assembly valve may be omitted on a dead end hydrant lead with no additional connections.

B. Place fire hydrants at all locations shown on the plans, or as directed by the Engineer.

C. Set each fire hydrant upon a concrete slab not less than four inches (4”) thick and not less than one (1) square foot of surface area.

D. Place eight (8) cubic feet of crushed rock, clean gravel or other suitable material to provide reservoir capacity so that the hydrant will completely drain when closed.

E. Set the hydrant perpendicular with large steamer nozzle facing nearest curb, and at a depth such that the center of the steamer nozzle is not less than eighteen inches (18”), nor more than twenty-four inches (24”) above nearest grade. Assure that the hydrant is sat at the bury line.

F. Contractor shall remove the chains from the steamer nozzles prior to final project inspection.

G. Polyethylene encasement of 8 mils thick shall be installed on all piping and appurtenances in contact with soil and shall conform to AWWA C105. Joint tape shall be self sticking PVC or polyethylene, 8 mils thick.

END OF SECTION

SECTION 33 13 00

DISINFECTION OF WATERLINES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This specification specifies the procedure for disinfection of water systems, and in general, conforms to AWWA C651, Disinfecting Water Mains including Section 4.3.9.

1.2 MEASUREMENT AND PAYMENT

A. Disinfection of waterlines will not be measured. Cost for work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work, shall be included in the unit price bid for waterlines in the Proposal.

PART 2 – PRODUCTS

2.1 MATERIALS

A. CHLORINE AND WATER

1. Chlorine

   Calcium hypochlorite, or equal, which contains sixty-five (65%) percent chlorine by weight.

2. Water

   Water for disinfection will be metered and furnished to the Contractor at no cost. Existing water lines are to remain isolated from newly laid water lines by a physical air gap until the original copy of the negative coliform test results have been received by the City Engineer from either the County Health Department or an approved TCEQ lab.

2.2 TESTING REQUIREMENTS

A. CHLORINE RESIDUAL-DROP DILUTION METHOD

The drop dilution method of approximating total residual chlorine is suitable for concentrations above 10 mg/L, such as are applied in the disinfection of water mains or tanks.

1. Apparatus

   a.) A graduated cylinder for measuring distilled water.

   b.) An automatic or safety pipet

   c.) A dropping pipet that delivers a one-milliliter (1 ml) sample in twenty (20) drops. This pipet is for measuring the water sample and should not be used for any other purpose.

   d.) A comparator kit containing a suitable range of standards.

2. Procedure

   a.) Ascertain the volume of the comparator cell and using an automatic or safety pipet, add 0.5 ml of orthotolidine for each 9.5 ml of distilled water to be added.

b.) Using a graduated cylinder, add a measured volume of distilled water.

c.) With the dropping pipet, add the water sample a drop at a time, allowing mixing, until a yellow color is formed that matches one of the color standards.

d.) Record the total number of drops used and the final chlorine value obtained.

e.) Calculate the milligrams per liter residual chlorine as follows:

i. Multiply by twenty the number of milliliters of distilled water used in Step 2.

ii. Multiply product in step a. by the final chlorine value in milligrams per liter recorded in Step 4.

iii. Divide the product found in step b. by the total number of drops of water sample recorded in Step 4.

PART 3 – EXECUTION

3.1 GENERAL

A. During the construction operations, workmen shall be required to use utmost care to see that the inside of pipes, fittings, jointing materials, valves, etc., which will come into contact with potable water be maintained in a sanitary condition.

B. Every effort must be made to keep the inside of the pipe, fittings, and valves free of all foreign matter, sticks, dirt, rocks, etc. As each joint of pipe is being laid, it must be effectively swabbed so that all foreign matter is removed. Placing dry powdered chlorine in the pipeline will be permitted in conjunction with certain methods of sterilization as specified by the Engineer. All fittings and exposed open ends of pipe must be blocked with a plug or capped until the line is completed.

C. Sterilization of the line, or any section thereof, shall not be commenced until the Engineer has approved the method, apparatus, sterilizing agent, and the section of the line.

D. When the entire pipeline, or certain section thereof, has been completed, tested, and made ready for use, the line or section of line shall be thoroughly sterilized according to the following procedure:

1. The Contractor shall provide all necessary taps to complete this section of the specifications.

2. The water main shall be flushed prior to disinfection.

3. The flushing velocity shall be greater than 2.5 feet per second. The rate of flow required to produce this velocity in various diameters is shown in Table 1. No site for flushing should be chosen, unless it has been determined by the Engineer or Inspector that drainage is adequate at that site. Flushing is no substitute for preventive measures taken before and during pipe laying. Certain contaminants, especially in caked deposits, resist flushing at any velocity.

TABLE 1

REQUIRED OPENINGS TO FLUSH PIPELINES (40 PSI RESIDUAL PRESSURE)

Pipe Size	Flow (gpm) Required to Produce 2.5 fps Velocity	Orifice Size (in.)	Number of Hydrant Outlet Nozzles	Size (in.) of Hydrant Outlet Nozzles
4	10	15/16	1	2-½
6	220	1-3/8	1	2-½
8	390	1-7/8	1	2-½
10	610	2-5/16	1	2-½
12	880	2-13/16	1	2-½
14	1200	3-¼	2	2-½
16	1565	3-5/8	2	2-½
18	1980	4-3/16	2	2-½

Note: A 2-½" hydrant outlet nozzle will discharge approximately 1,000 gpm and a 4-½" hydrant outlet nozzle will discharge approximately 2,500 gpm with 40 psi residual pressure.

E. METHODS OF CHLORINE APPLICATION

1. Continuous Feed Method

Note: This method is suitable for general applications.

a. Water from the existing distribution system, or other pre-approved sources of supply, shall be made to flow at a constant, measured rate into the newly laid pipeline. The water shall receive a dose of chlorine concentration until the water in the pipe maintains a minimum of fifty milligrams per liter (50 mg/1) available chlorine. To assure that this concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedures described herein.

Note: In the absence of a meter, the rate may be determined either by placing a pitot gauge at the discharge, or by measuring the time to fill a container of known volume.

Table 2 gives the amount of chlorine residual required for each 100 feet of pipe of various diameters. Solutions of one percent (1%) chlorine may be prepared with approximately one pound (1 lb.) of calcium hypochlorite (65% strength) in 8.5 gallons of water.

TABLE 2
Chlorine Required to Produce 50 Mg/1
Concentration in 100 feet of Pipe
by Diameter

Pipe Size (in.)	100% Chlorine (lb/100ft)	1% Chlorine Solution (gal/100ft)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88
16	0.427	5.12
18	0.540	6.48
24	0.960	11.50

Pipe Size (in.)	100% Chlorine (lb/100ft)	1% Chlorine Solution (gal/100ft)
30	1.500	18.00
36	2.160	25.90
42	2.940	35.30

b. During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least twenty-four (24) hours during which time, all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this twenty-four (24) hour period, the treated water shall contain no less than fifty (50) milligrams per liter and no more than one hundred (100) milligrams per liter chlorine throughout the length of the main. A dosage of more than the maximum allowable chlorine will require the Contractor to dilute the flush water with one of the TCEQ approved dilution chemicals. The chemical and description of procedure will be submitted in writing to the Engineer for approval.

2. Slug Method

This method is suitable for use with mains of large diameter for which, because of the volume of water involved, the continuous feed method is not practical.

a.) Water from the existing distribution system shall be made to flow at a constant, measured rate (see C.1.a. Note) into the newly laid pipeline. The water shall receive a dose of chlorine, also fed at a constant, measured rate. The two (2) rates shall be proportioned so that the concentration of the water entering the pipeline is maintained at no less than 300 milligrams per liter. As the chlorinated water passes along the line, it shall expose all interior surfaces to a concentration of at least 300 mg/L for at least three (3) hours. The application shall be checked at a tap near the upstream and downstream end of the line by chlorine residual measurements made according to the procedures described herein.

b.) As the chlorinated water flows past tees and crosses, related valves and hydrants shall be operated so as to disinfect appurtenances.

3. Dry Treatment during Installation

The dosage and application of sodium hypochlorite will be determined by the following:

a.) Calculate weight of sodium hypochlorite required for water to be treated utilizing Table 2.

b.) Add required amount of solution at the bell of each pipe as it is installed.

E. FINAL FLUSHING

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is less than three milligrams per liter (3 mg/1). Chlorine residual determination shall be made by the Inspector to ascertain that the heavily chlorinated water has been removed from the pipeline.

F. BACTERIOLOGIC TESTS

1. Before the water main is placed in service, a sample or samples shall be collected from points designated by the Inspector and tested for bacteriologic quality. This sample shall be collected 24 hours after final flushing. The test shall show the absence of coliform organisms before the water main may be placed in service. At least one (1) sample per one thousand (1000) feet of new line or portion thereof shall be taken. Sampling shall be supervised by the Inspector. Samples shall be submitted by the city to a TCEQ approved laboratory and/or County Health Department for analysis.

2. Samples of bacteriologic analysis shall be collected in sterile bottles obtained from the Brazos County Health Department. Samples shall be collected at points specified by the City Engineer.

3. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

G. REPETITION OF PROCEDURE

1. If the initial disinfection fails to produce samples with no coliform present, the contractor shall re-disinfect the line following the procedures stated in 695.04 of this specification until samples indicating no coliform present have been obtained. When the samples indicate no coliform present and the City Engineer has received original copies of the test report, the main may be placed in service.

3.2 PROCEDURE AFTER CUTTING INTO OR REPAIRING EXISTING MAINS

A. The procedure outlined in this section applies primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

1. Trench "Treatment"

When an old line is opened, either by accident or by design, the excavation will likely be wet and badly contaminated. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from such pollution. Tablets have the advantage in such a situation because they dissolve slowly and continue to release hypochlorite as water is pumped from the excavation.

2. Main Disinfection

a.) *Swabbing and Flushing.* The following procedure is considered as a minimum that may be used.

i. Swabbing With Hypochlorite Solution: The interior of all pipe and fittings used to make the repair (particularly couplings and tapping sleeves) shall be swabbed with a 5 percent hypochlorite solution before they are installed.

ii. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valving and hydrant locations permit, flushing from both directions is recommended. Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated.

3. Slug Method: In addition to the swabbing and flushing procedures of section B.1., the section of main in which the break is located can be flushed and chlorinated using the slug method where practical, as determined by the Engineer or Inspector. This method requires isolating the section of main, shutting off all service connections, flushing the main, and chlorinating the main as described in the Slug Method in C.2, except that the dose may be increased to as much as 500 mg/1, and the contact time reduced to as little as ½ hour. After chlorination, flushing shall be resumed and continued until discolored water is eliminated.

4. Sampling: Bacteriologic samples shall be taken after repairs to provide a record by which the effectiveness of the procedures used can be determined by the Inspector. If the direction of flow is unknown, samples shall be taken on each side of the main break.

END OF SECTION

SECTION 33 13 10

HYDROSTATIC TESTS

PART 1 - GENERAL

1.1 DESCRIPTION

This item shall consist of the hydrostatic testing of all waterlines, fire hydrants, and appurtenances.

1.2 MEASUREMENT AND PAYMENT

Testing of waterlines will not be a measured item. Cost for work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work, shall be included in the unit price bid for waterlines in the Proposal.

TABLE A
Loss in Gallons Per Hour Per Foot of Pipe

Length	4”	6”	8”	10”	12”	18”	20”	24”
50	.04	.06	.08	.10	.12	.18	.195	.235
100	.08	.12	.16	.195	.235	.355	.395	.475
200	.16	.235	.315	.395	.475	.71	.785	.945
300	.235	.355	.475	.59	.71	1.065	1.185	1.42
400	.315	.475	.63	.785	.945	1.42	1.58	1.89
500	.395	.59	.785	.985	1.185	1.775	1.975	2.365
600	.475	.71	.945	1.185	1.42	2.13	2.365	2.84
700	.555	.83	1.105	1.38	1.655	2.485	2.76	3.31
800	.63	.945	1.265	1.58	1.895	2.84	3.155	3.785
900	.71	1.065	1.42	1.775	2.13	3.195	3.55	4.26
1000	.79	1.185	1.58	1.975	2.365	3.55	3.945	4.735

Calculations Based on a Loss of 25 Gal./Diameter inch of Pipe/Mile of Pipe/Day

PART 2 – PRODUCTS

2.1 MATERIALS

A. EQUIPMENT PROVIDED BY CONTRACTOR

The contractor shall furnish pump, pipe connections and all necessary apparatus (including gauges and meters) to hydrostatically test the water lines according to this specification.

B. WATER FOR TESTING

Water for testing will be furnished by the City. All connections of new pipeline must be isolated from existing potable water lines until a negative coliform test report from the County Health Department or TCEQ approved lab has been received.

PART 3 – EXECUTION

3.1 GENERAL

A. All water mains including water services shall be hydrostatically tested and sterilized according to SECTION 33 13 00 - DISINFECTION OF WATERLINES, prior to acceptance by the City.

B. This section specifies hydrostatic testing of water distribution lines. The contractor shall test waterlines after backfilling, but before replacement of pavement (if applicable.)

C. Test waterlines in sections, by pressurizing the new system to 150 psi and holding that pressure for a total test time of 4 hours.

3.2 PRESSURIZATION

A. Each valved section of pipe shall be filled with water slowly. The test pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the City Engineer.

3.3 AIR REMOVAL

A. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation stops shall be closed and the test pressure applied twenty-four (24) hours after filling the line.

B. At the conclusion of the pressure test, the corporation stops shall be removed and plugged, or left in place at the discretion of the City Engineer. Any added corporation cocks must be shown on as-built plans if they are to remain in place.

3.4 EXAMINATION

A. All exposed pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damage or defective pipe, fittings, valves or hydrants that are discovered following the test shall be repaired or replaced with sound material and the test shall be repeated until it is satisfactory to the City Engineer.

1. Allowable Pressure Loss

   a.) For DIP and PVC

   No pipe installation will be accepted if the water loss is greater than that shown in Table A. No additional leakage will be included for fittings.

   b.) When hydrants are in the test section, the test shall be made against the closed hydrant and not the valve on the lead.

2. Acceptance of Installation

   a.) Acceptance shall be determined on the basis of allowable pressure loss**.** If any test of pipe discloses a pressure loss greater than that specified, the Contractor shall, at his own expense, locate and repair the defective material until the pressure loss is within the specified allowance.

   b.) All visible leaks are to be repaired, regardless of the amount of pressure loss.

END OF SECTION