SECTION 6
POTABLE WATER SPECIFICATIONS

SUBSECTION 6.01
WATER FACILITIES GENERAL CONSTRUCTION STANDARDS

I. SCOPE

Construction performed under these specifications shall cover the installation of water pipelines and appurtenances as shown on the plans and itemized in the proposal.

II. WORKMANSHIP

These specifications contain instructions and descriptions covering the major items of construction and workmanship necessary for building and completing the various units or elements of the project. The specifications are intended to be so written that only first class workmanship and finish of the best grade and quality will result. The fact that these specifications may fail to be so complete as to cover all details will not relieve the Contractor of full responsibility for providing a completed project of high quality, first class finish, good appearance, and satisfactory operation, all within the intent of the plans and specifications.

III. SITE

The Contractor shall be responsible for viewing the proposed routes prior to submission of his proposal and shall satisfy himself as to the conditions which may be encountered.

IV. RIGHT-OF-WAY

Construction will be in locations as shown on the plans which may include streets, alleys, easements or other right-of-way. The Contractor shall make provisions for his working space to limit interference with traffic and other utilities. The City shall secure necessary permits for construction and the Contractor shall abide by all requirements of the agencies controlling the right-of-way. Special conditions or requirements regarding right-of-way are included in the "SPECIAL REQUIREMENTS" of the contract.

V. OPERATION OF EXISTING VALVES

The Contractor shall not operate any valves or fire hydrants in the existing City water works system. The operation of valves in the existing water system shall be performed by City of Amarillo Utilities personnel upon prior notice.

VI. FENCES

Where it is necessary for the Contractor to cut fences, such fences shall be protected, repaired, and replaced by the Contractor in a condition equal to, or better than, the original condition. Cuts in fences shall be made in a neat and workmanlike manner, and the Contractor shall be responsible for preventing the loss of stock or pets through gates, breaks, or holes in fences due to construction operations.

VII. NOTICE TO CUSTOMERS, INTERRUPTION OF SERVICE

When water service must be interrupted during the construction of any water distribution project, it will be the responsibility of the Contractor to notify all affected customers prior to the interruption. The Contractor shall coordinate all interruptions with the customers and the City, notifying them of the cause of service interruption and the approximate time required before service will be restored. If the interruption is to be for an extended period of time, the Contractor shall make arrangements for temporary service. The City

shall make all required valve closings and inform the Contractor of the areas impacted by the shut down. When the Contractor is required to remove an existing plug or tie into an existing water main, the Contractor shall satisfy himself that the line is no longer under pressure and conditions are safe before beginning his work.

VIII. STERILIZATION

The Contractor shall sterilize new water mains in conformance with AWWA C651 to provide a minimum chlorine residual of twenty-five parts per million (25 ppm) after twenty-four (24) hours. After the City has verified the residual chlorine dosage, the Contractor shall flush the main until the residual chlorine is no higher than that prevailing in the existing system and a turbidity test has been completed yielding a turbidity of 0.50 NTU or less. After this has been achieved, samples at one thousand (1000) feet intervals, or as otherwise determined by the City, shall be collected and tested for bacteriological quality and the absence of coliform organisms by City personnel. All test openings should be sterilized with a flame, and all appurtenances used to collect the samples shall be disinfected. Samples shall only be taken before 3:00 PM between Monday and Thursday of each week. Should the sample indicate the existence of coliform organisms or an excess of bacteria, the Contractor shall be required to repeat the disinfection and testing procedures until satisfactory results are obtained. The section of pipe being tested shall remain isolated from the existing distribution system until satisfactory test results have been obtained. The Contractor is responsible for providing a sufficient number of locations, properly spaced, at which tests may be taken from. If a tap is required, the Contractor shall install it according to Subsection 6.05 "WATER SERVICE LINE REPLACEMENTS" up to the curb stop. The curb stop shall then be covered with a meter box provided by the City of Amarillo. The cost for this shall be included in the price bid for lineal feet of pipe. **Final payment shall not made and the line shall not be placed in service until the bacteriologic tests indicate the absence of coliform organisms and a satisfactory bacteria count.**

IX. MEASUREMENT AND PAYMENT

A. General:

1. The bid price for each and every item set forth in the proposal shall include furnishing all supervision, labor, tools, materials, machinery, appliance, and equipment appurtenant to and necessary for construction and completion in a first-class manner of all work as herein specified in strict accordance with these specifications and accompanying plans. The bid price shall also include any and all kinds, amount or class of excavation, backfilling, pumping or drainage, disposal of any and all surplus materials, testing, permanent protection of all overhead, surface or underground structures and lines, removal and replacement of any spools, conduits, pipe lines, cables, appurtenances and connections, property damage insurance, patent fees and royalties, risk due to the elements, and profits unless otherwise specified.

2. The bid price shall also include all other incidentals not specifically mentioned above that may be required to fully construct each and every item complete in place in accordance with the true intent and meaning of the specifications and accompanying plans.

3. On the twenty-sixth (26th) day of each month, all measurements for payment of pipe in place shall be made. The pipe and appurtenant construction shall be paid for at the unit prices set forth in the proposal. Payment estimates shall be prepared by the Engineer each month from the City's report for materials installed and any invoices submitted by the Contractor for materials on hand, see Subsection B below.

4. Final payment shall not be made until all conditions of the specifications are met, all known claims have been paid, and the installation has passed all testing requirements.

B. **Materials On Hand:** Payment for materials on hand shall be made at the invoice price paid by the Contractor, providing that invoices are provided to the Engineer by the twenty-sixth (26th) day of the month. In addition, materials must be on the job site for payment to be made. The Contractor shall indicate which bid items the payment for materials on hand will apply towards. The Contractor is responsible for protection of all material on hand. The City will not be responsible for damages or losses of material for any reason. **Material stored at any location other than the job site shall not be considered for payment.**

C. **Paving Cuts:** All paving cuts shall be paid at the unit price bid and shall be measured using the average length and multiplying it by the average width. **Payment for paving cuts shall at no time be larger than the size shown on the plans unless the increased size is approved ahead of time in writing by the Engineer.**

D. **Pipe and Fittings:** Measurement of all pipe shall be by linear foot through the center of all fittings and valves. Mechanical joint ductile iron and cast iron fittings shall be paid by weight including glands, bolts, and gaskets. Where AWWA C153 ductile iron short body fittings are specified payment shall be based on ductile iron fitting weights only, even if cast iron fittings are used. **The cost of all couplings and adapters between different types of pipe shall be included in the cost per lineal foot of pipe installed. It is the responsibility of the Contractor to verify existing pipe materials and sizes.** Fittings for all concrete steel cylinder pipe shall be included in the cost of the pipe per linear foot.

E. **Valves and Valve Boxes:** Valves shall be measured by the units of various sizes required complete in place. Payment will be made at the unit price bid per valve of the various sizes and types required, and payment shall be full compensation for the valve installation, including cast iron valve boxes and concrete cradles, all in accordance with the plans and specifications.

F. **Concrete Blocking:** Concrete blocking will be measured by the number of cubic yards in place as shown on the drawings or as directed by the Engineer. Payment will be made at the unit price bid per cubic yard, which shall be full compensation for excavation, furnishing and placing of concrete, forming, and all other work necessary for the complete unit in strict accordance with the plans and specifications. **In no case shall the quantity of blocking paid exceed the amount shown on the plans unless the increase is approved in writing ahead of time by the Engineer.**

G. **Wet Connection:** The price bid for the wet connection will be full compensation for the removal/pumping of a **minimum of one-thousand (1000) gallons of water** required for an existing water main connection or repair. The City shall determine whether the minimum of one-thousand (1000) gallons was removed by the Contractor in order to proceed with the work. In addition, **if one connection to an existing water main will drain an entire main being worked on, no compensation for additional wet connections to this main shall be made.** The price for making any other adjustments necessary shall be included in the price bid to furnish and install each item.

X. CONSTRUCTION STAKING

The Engineer shall be responsible for all construction staking on this project. The Engineer shall provide permanent benchmarks from which all other elevations shall be established. The Contractor shall take the necessary precautions to preserve and protect all construction staking. Replacement of construction stakes shall be at the expense of the Contractor.

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SUBSECTION 6.02
WATER CONSTRUCTION MATERIALS

I. GENERAL

A. All newly installed pipes and related products must conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and must be certified by an organization accredited by ANSI. Only material of the best quality and grade will be accepted. The fact that the specifications may fail to be sufficiently complete or clear in some detail will not relieve the Contractor of full responsibility for providing materials of high quality and protecting them adequately until incorporation into this project. Only materials contained within these specifications are approved for use.

B. The Contractor shall promptly remove from the site all materials found to be damaged, not meeting the specifications, or not approved, whether they have been installed or not. Where there are differences between these specifications and AWWA Standards on materials, the more stringent shall govern. **Inspection before installation shall not relieve the Contractor from the responsibility of furnishing and installing specified undamaged materials.**

II. DUCTILE IRON PIPE

All ductile iron pipe shall be manufactured in accordance with AWWA C151 and shall have physical properties of sixty thousand (60,000) psi tensile strength and forty-two thousand (42,000) psi yield strength and ten (10) percent elongation. Pipe four (4") inch through twelve (12") inch shall be pressure class three hundred fifty (350) psi minimum. Pipe sixteen (16") inch through twenty (20") inch shall be pressure class two hundred fifty (250) psi minimum. Pipe twenty four (24") inch shall be pressure class two hundred (200) psi minimum. Pipe larger than twenty four (24") inch shall be pressure class one hundred fifty (150) psi minimum. The pipe shall have a one (1) mil inside coat of asphaltic material which conforms to AWWA C104. All joints in the pipe shall be the slip-on rubber gasket joint of a type conforming to AWWA Standard C111.

III. POLYVINYL CHLORIDE PRESSURE PIPE

A. All four (4) inch through twelve (12) inch diameter PVC pressure pipe shall conform with AWWA Standard C900 - Pressure Class 150 - DR 18. All sixteen (16) inch through thirty six (36) inch diameter PVC pipe shall conform with AWWA Standard C905 - Pressure Class 165 - DR 25. All PVC pressure pipe shall have cast iron pipe outside diameter and rubber ring joints. The standard nominal length of the pipe shall be twenty (20) feet, with a plus or minus tolerance of one (1) inch.

B. Joints shall provide for contraction and expansion at each joint with a rubber ring and an integral thickened bell as part of each joint. Pipe and fittings must be assembled with a non-toxic lubricant. All field cut joints shall have square cut ends and beveled as recommended by the manufacturer. All PVC water pipe shall be listed by Underwriters Laboratories.

C. The pipe marking shall include: Nominal size and outside diameter (O.D.) base, material code designation, Dimension ratio number, AWWA pressure class, AWWA designation number, Manufacturers name or trademark and production code, Seal of the testing agency that verified

the suitability of the pipe material for potable water service and National Sanitation Foundation Seal of Approval. All plastic pipes for use in public water systems must also bear the National Sanitation Foundation Seal of Approval (NSF-pw).

IV. CONCRETE STEEL CYLINDER PIPE

A. Concrete cylinder pipe shall consist of a welded sheet steel cylinder lined with a dense concrete lining around which is placed reinforcing bars wound helically under measured tension, with a dense concrete coating covering the cylinder and the bars, and with steel joint rings of the bell and spigot type for rubber gasket. Pipe shall be approximately thirty-two (32) feet nominal lengths, except for shorter lengths as required by special conditions. The pipe and pipe fittings shall comply with AWWA Standard C303 - Pretensioned Concrete Pressure Pipe unless noted otherwise in the plans or specifications. All pipe and fittings, outlets, etc., shall meet the requirements of the Underwriters Laboratories, Inc. and shall be acceptable by the National Board of Fire Underwriters. All joints shall be grouted according to manufacturer's recommendations.

B. The class of pipe shall be Class 150 unless noted otherwise in the plans or specifications.

C. All fabricated specials, bends, closures, and other connections to main line valves or other pipe shall be fabricated from steel plate or sheet lined and coated with cement mortar or steel sheets surrounded by one or more reinforcing steel cages all encased in concrete. These specials and bends shall be of equal strength to the adjoining pipeline. Each special and each length of straight pipe shall have plainly marked on either the bell or spigot end, the class for which it is designed, reference number, and date of manufacture. All beveled pipe shall be marked with the amount of bevel.

D. Shop drawings showing the pipe and fittings to be furnished, shall include a location-profile, and shall include a tabulated layout schedule, with reference to the stationing on the contract drawings. Such drawings shall be subject to the approval of the Engineer and fabrication of pipe and fittings shall not be commenced until such drawings have been approved by the Engineer. **Reproducible drawings of the final approved shop drawings shall be furnished to the Owner.**

E. Flanged openings shall be provided where valves will be attached to the openings.

F. Installation of concrete pipe in steel casing shall be of the thickwall type or will have collars to prevent the weight of the pipe from resting on the joints of the concrete steel cylinder pipe.

V. POLYETHYLENE PRESSURE TUBING

A. All distribution pipe two (2) inches in diameter and smaller shall be polyethylene pressure tubing (PE 3408 - C.T.S.). All PE pipe shall conform with AWWA C901 Class 200. All PE pipe shall have dimensions conforming to the outside diameter dimensions of copper tubing.

B. The pipe marking shall include: Nominal size, PE code designation, the word "Tubing" and the dimension ratio, AWWA pressure class, AWWA designation number, Manufacturers name or trademark and production code, Seal of the testing agency that verified the suitability of the pipe material for potable water service.

C. Bends shall occur no closer than ten (10) pipe diameters from any fitting or valve. The minimum radius of bends shall be no less than thirty (30) pipe diameters. Kinked tubing shall not be used. Precautions shall be taken to prevent kinking during installation and care shall be taken to ensure that kinking does not develop after installation.

D. Connections shall be compression connections. Stainless steel solid inserts shall be provided at each compression connection.

VI. PIPE FITTINGS

Mechanical joint fittings and specials for polyvinyl chloride pressure pipe and ductile iron pressure pipe twenty four (24) inches and smaller shall be ductile iron compact fittings conforming to AWWA C153 - latest revision, unless specified otherwise. Mechanical joint fittings and specials for polyvinyl chloride pressure pipe and ductile iron pressure pipe larger than twenty four (24) inches shall be cast iron AWWA C110 - latest revision. Pipe fittings shall be coated inside and outside with coal-tar dip as specified in AWWA Standard C151 - latest revision. The cost of all couplings or adapters between different types of pipe shall be furnished by the Contractor, and the price of same shall be included in the cost per lineal foot of pipe installed. The Contractor may use AWWA C110 cast iron fittings for piping twenty four (24) inches and smaller, but payment shall be made at the equivalent ductile iron weights, unless AWWA C110 fittings have been specified.

VII. CONCRETE BLOCKING

Concrete shall be of Portland cement, fine aggregate and coarse aggregate, all materials complying with ASTM C 33 - latest revision and ASTM C 150 - latest revision, of the American Society for Testing Materials. Materials shall be properly proportioned and mixed to produce a twenty-eight (28) day compressive strength of three thousand (3000) psi. Concrete blocking shall be mixed with only enough water to form a stiff plastic mix which can be readily tamped or compacted in place.

VIII. GATE AND BUTTERFLY VALVES

A. GENERAL

1. Unless otherwise specified all valves twelve (12) inches and smaller in diameter shall be gate valves. Unless otherwise specified all valves shall have mechanical joint connections.

2. Flanges for valves shall be drilled to match connecting flanges. All flanges shall conform to the Standard Specification of the American National Standards Institute (ANSI). Flanges shall be Class 125 for all flanged pipe, fittings, and valves.

3. Valve stem extensions shall not be required unless specified in the plans or specifications.

B. GATE VALVES

All gate valves shall be either of the double disc or the resilient-seat type as specified herein. All double disc gate valves shall have an internal wedging type parallel seat with a cast iron body and bronze mountings. Gate valves shall meet working pressures of two hundred (200) psi and shall be in strict accordance with AWWA Standard C500 "Metal-Seated Gate Valves For Water Supply

Service", or AWWA Standard C509 "Resilient-Seated Gate Valves For Water Supply Service." Gate valves which have a working pressure other than specified above shall be in accordance with all applicable requirements of AWWA specifications. All gate valves shall be non-rising stem, furnished with a two (2) inch square operating nut, and turn counterclockwise to open.

C. BUTTERFLY VALVES

All butterfly valves shall be Class 250 B, mechanical joint, rubber seated, horizontal valves, and shall meet the specifications of AWWA Standard C504. Butterfly valves shall be furnished with certified copies of the reports covering the leakage test (AWWA Sec. 5.3) and the hydrostatic test (AWWA Sec. 5.4) in accordance with Section 5.5 of the AWWA Standard C504. The butterfly valves shall be furnished with a two (2) inch square operating nut, operating counter-clockwise to open, with a manual type geared operator totally enclosed and suitable for direct bury service. Operator type and gearing ratio shall be submitted to the Engineer for approval before installation or payment is made. Valve Actuators shall conform to AWWA Standard C504.

IX. TAPPING VALVES

Tapping valves shall meet or exceed all of the requirements of gate valves as specified previously. Tapping valves from four (4) inches through twelve (12) inches in size shall be designed for a working pressure of two hundred (200) pounds per square inch. Tapping valves larger than twelve (12) inches in size shall be designed for a working pressure of one hundred seventy-five (175) psi. Tapping valves shall be of the non-rising stem type and open counter-clockwise. The inlet flange for tapping valves shall be Class 125 as specified in ANSI B16.1 and the outlet shall be mechanical joint for the branch main unless specified otherwise.

X. VALVE BOXES

A. The Contractor shall furnish and install cast iron valve boxes for all buried service valves other than air release valves. Valve boxes for gate valves shall be comprised of the following sections: base, bottom section, extension section (if necessary), top section, and cover. Valve boxes for butterfly valves shall be comprised of the following sections: base, bottom section, extension section (if necessary), top section, and cover. The valve box shall be a Tyler Pipe Screw-Type 6860 series, Size "A", or approved equal. Gate valves eight (8") inches and smaller shall use a No. 6 Round Base, ten (10") inch and twelve (12") inch valves shall use a No. 8 Round Base, and butterfly valves shall use a No. 160 Oval Base. Extensions of valve boxes shall be accomplished by using cast iron extension sections made for the specific valve box being used as manufactured by Tyler Pipe. Valve box sections shall be arranged in such a way as to provide the longest sections available for the valve box.

B. After the valve box is in place and the valve is operating properly, backfill material shall be firmly tamped around the outside so as to hold the box in the proper position. The top of the box shall be adjusted to the proper elevation and securely held in place. **Valves in asphalt or concrete shall be set so no depression is created in the final asphalt or concrete surface.** Valve boxes which prohibit proper operation of the valve or have settled during backfilling or compaction of the backfill shall be excavated and reset properly at the expense of the Contractor.

XI. FIRE HYDRANTS

1. All fire hydrants shall conform to AWWA Standard C502 "Dry-Barrel Fire Hydrants." Hydrant main valves shall be the compression type valve, opening against water main pressure and closing with water main pressure in a manner that the water pressure will hold the valve closed if the hydrant is broken off. The barrels and valve stems shall contain breakable "safety" couplings designed and situated so that the impact of a traffic collision will completely sever the hydrant through the plane of the breakable couplings before any other part of the hydrant is damaged. The safety coupling of the barrel shall be a flanged joint with breakable flange ring segments. The safety coupling of the valve stem shall consist of a breakable, replaceable sleeve or segment held in place by threaded, corrosion-resistant bolts or screws, or by bronze or stainless steel drift pins for easy removal. The top of the lower stem is to be below the top of the lower barrel so a tire cannot depress the stem and open the main valve.

2. The valve stem shall open left or counter-clockwise and turn right or clockwise to close. A visible arrow and the word "Open" shall be cast in relief. The operating nut shall be a one (1") inch square operating nut.

3. The fire hydrant inlet connection shall be an elbow with AWWA Standard bell designed for six (6) inch nominal diameter pipe. All fire hydrant inlets shall be mechanical joint and all glands, gaskets, bolts and nuts are to be furnished as part of the fire hydrant. Harnessing lugs shall be provided on all connections.

4. Each hydrant shall be provided with an outlet to drain the hydrant when the main valve is closed. The main valve shall have a bronze drain ring and a bronze seat ring. All bronze drain rings are to be secured to the shoe by a drain ring housing (to permit lower barrel removal with the shoe under pressure).

5. All hydrants shall be equipped with two hose nozzles with two and one-half (2 1/2) inch inside diameters and one pumping nozzle with a four and one-half (4-1/2) inch inside diameter, meeting ANSI Specification B26 for "National (American) Standard Fire" hose coupling screw threads. Caps shall have one (1") inch square operating nuts.

6. The minimum bury length shall be four (4) feet. The fire hydrant shall be adjusted to bring the flange of the hydrant above the finished ground or paving elevation. Where extra depth is required for the fire hydrant connection, the Contractor shall install the deep bury hydrant as noted on the plans and details.

7. The exterior surfaces of the hydrant below ground shall be coated with an asphalt varnish, two (2) coats. All exterior surfaces above ground shall have red oxide primer and the final coat shall be Sherwin-Williams Kem Lustral Orange No. F-65-E1, or approved equal.

H. All fire hydrants shall be Mueller Centurion or approved equal.

XII. DEEP BURIED FIRE HYDRANTS

1. A deep buried fire hydrant shall be defined as a fire hydrant with a buried length of greater than 5.5 feet. The hydrant shall be adjusted to bring the flange of the hydrant above the finished grade or paving elevation. All costs for a deep buried fire hydrant shall be included in the bid item "Deep Buried Fire Hydrant". No additional compensation shall be made.

XIII. TAPPING SLEEVES AND CROSSES

All tapping sleeves and crosses for pipe twelve (12) inches in diameter and smaller shall be either cast iron or ductile iron sleeves. Tapping sleeves shall be rated for a two hundred (200) psi working pressure with a Class 125 outlet flange as specified in ANSI B-16.1. All tapping sleeves and crosses for PVC, ductile iron, cast iron, or asbestos cement pipe larger than twelve (12) inches in diameter shall be cast iron, ductile iron, or stainless steel construction. Stainless steel tapping sleeves and crosses shall be all stainless steel, no carbon steel or epoxy coated carbon steel shall be acceptable. Tapping sleeves for concrete steel cylinder (CSC) pipe shall be as recommended by the pipe manufacturer.

XIV. FLUSH ASSEMBLY

When shown on the plans, the Contractor shall install a two (2) inch flush assembly at the end of dead end water lines for flushing and testing purposes. The flush assembly shall include a minimum of:

1. A two (2) inch brass nipple at least eight (8) inches in length extending out of the drilled plug
2. A two (2) inch rising stem solid wedge bronze gate valve with an iron or brass hand wheel operator
3. A two (2) inch brass ninety degree (90°) bend (Street Ell is acceptable)
4. Two (2) inch by twelve (12) inch brass piping extending up out of the 90° bend
5. A two (2) inch brass collar at the end of the two (2) inch brass piping
6. City of Amarillo standard meter boxes as required stacked to grade and lid.

Meter boxes shall be provided by the City of Amarillo as needed and shall be set so that the top of the meter box is slightly above finished grade. In addition to the above list of materials, the Contractor shall be required to install concrete blocking behind the drilled plug for blocking purposes. All concrete blocking shall be paid by the cubic yard at the unit price bid for same.

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SUBSECTION 6.03
EXCAVATION AND INSTALLATION OF WATER PIPE AND FITTINGS

I. SCOPE

This section covers excavation work and installation of pipe and fittings, which shall include the necessary clearing, grubbing, preparation, removal and disposal of all debris, the excavation, handling, storage, transportation, disposal of all excavated material, structures or parts of structures in the area of or along the pipe, its connections and accessories, preparation of subgrades of adjacent property, backfilling, construction of fills and embankments, surfacing and grading, and other appurtenant work. The definitions in Section II are presented for the convenience of the Contractor and for clarification of these specifications.

II. DEFINITIONS

A. **Select Excavated Material** - Material which is excavated and removed from the ditch with a maximum dimension of no greater than one-half (1/2) inch which contains sands, clayey sands or clayey gravel and does not contain top soil or organic material. Fill sand is an approved select excavated material.

B. **Approved Backfill** - Excavated material which has a maximum dimension of three (3) inches and contains no frozen material, trash, debris, concrete, rock or organic material. Fill sand may substituted for the excavated material for backfill.

C. **Class I Material** - Angular, one-fourth (1/4) inch to three-fourths (3/4) inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

D. **Class II Material** - Coarse sands and gravels with a maximum particle size of three-fourths (3/4) inch, including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW, and SP are included in this class. Some approved examples include fly ash, dolomite screenings, coarse sand, and blow sand.

E. **Class III Material** - Fine sand and clayey gravels, including fine sands, sand-clay mixtures and gravel clay mixtures. Soil types GM, CC, SM and SC are included in this class.

III. CLASSIFICATION OF EXCAVATION

A. No classification of excavation will be made. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the contract work, regardless of the type, character, composition, or condition thereof.

B. If the excavated material is determined by the Engineer to be of an unsuitable quality for approved backfill, the Contractor shall import a material approved by the Engineer for backfilling purposes. The cost of this backfill material shall be paid per unit volume on material only. The volume shall be determined from actual trench dimensions, with the trench width not to exceed the diameter of the pipe plus twenty-four (24) inches.

C. Bidders must satisfy themselves as to the actual existing subsurface conditions, including but not limited to the depth, location, and sizes of pipe, cables and lines of various kinds in place.

IV. BLASTING

A. It is anticipated that no material will be encountered that will require blasting; but, should such material be encountered, no blasting will be permitted until proper precautions are taken for the protection of persons and property. Authorization for blasting must be received from the proper officials prior to any preparations for blasting. The Contractor shall be responsible for all damages incurred as a result of blasting, and shall repair any damage immediately at his own expense.

B. Blasting will not be permitted in close proximity to existing structures or utilities which may be damaged from such operation or within twenty (20) feet of sanitary sewers or water mains six (6) inches in diameter or over. Blasting will be permitted only after proper precautions are taken for the protection of persons and property. When blasting is authorized, the blast shall be covered with heavy timbers chained together, a rope mat, or some other equally effective method. The amount of explosive in each charge and the number of simultaneous discharges must be so limited that no damage will be caused to existing utilities, structures, improvements, or property of any kind. Not more than fifty (50) pounds of dynamite shall be kept on the work site at any time. The exposed end of the water main shall be covered with plank during each blast. The Contractor's methods relative to blasting shall conform to all state laws and municipal ordinances.

V. SAFETY

A. The Contractor is advised that portions or all of the project work areas are adjacent to or crossing existing pipelines or communication cables and are subject to vibration from traffic. Soil in any area of construction may have been disturbed and may be unstable. **The Contractor shall have sole responsibility for determining what safety procedures and equipment are necessary for protecting his employees and the general public. The Contractor shall have sole responsibility for implementing safety procedures and for the proper use of all safety equipment to insure a safe working place and working environment.** The Contractor shall use as a minimum standard the Occupational Safety and Health Administration (OSHA) regulations and guidelines concerning trench safety. **The cost of such processes, equipment, and procedures shall be the responsibility of the Contractor.**

B. The Contractor is hereby advised that the work area in and around water may contain viruses, microorganisms, and bacteria that may be hazardous to human health. In addition, toxic and explosive gases may be present in the work area. The Contractor shall have the sole responsibility for testing and determining what safety procedures and equipment are necessary to protect his employees and the general public from these hazards. The Contractor shall have sole responsibility for implementing those safety procedures and for the proper use of all safety equipment.

C. The jobsite shall be kept in a neat and orderly fashion by the Contractor. All trash, rubbish, etc. shall be kept cleaned up on the jobsite. At the completion of each workday the Contractor shall leave a neat and orderly jobsite, backfill open holes if possible or provide suitable barricades and or fencing. Equipment shall be parked or stored in such a manner as to preclude the possibility of an open excavation caving in. Other equipment shall be stored in a secure fashion eliminating the possibility of damage and/or accidents occurring due to weather and or other incidents. Materials shall be stored in a manner which will eliminate any danger to the public. All traffic control devices shall be maintained at least on a daily basis. More frequent maintenance may be required, especially during bad weather, high traffic periods, and weekends. It is the sole responsibility of the Contractor to perform these duties and no additional compensation shall be due the Contractor for performing these duties.

VI. TRENCH EXCAVATION

A. General:

1. The Contractor shall provide, before commencing any excavation, ample equipment and materials to insure that the work will be carried on without interruption and in such manner as to prevent damage to all existing installations.

2. Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption of traffic. Excavated material shall be piled in a manner which does not block sidewalks and driveways or obstruct traffic. Driveways must be immediately cleared to permit free ingress and egress. Gutters and drainage channels shall be kept clear, or other means of securing proper drainage shall be provided. Where traffic must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. Hydrants under pressure, valves boxes, fire or police call boxes, and other utility controls shall be left unobstructed and accessible during the construction period.

3. **Equipment must not be allowed to bear on driveways, concrete curbs, sidewalks, gutters, or directly on pavement.** Where the excavation and backfilling is along, across, or adjacent to driveways, concrete curbs, sidewalks, gutters, or directly on pavement, sufficient timbers or planking must be placed under the tracks and wheels of the excavating and backfilling machines to completely protect the curbs, gutters, sidewalks, driveways, and pavement. The use of machinery must be controlled to preclude possible danger or damage to existing structures and/or existing pipes, valves, or other underground structures. Damage to curbs, gutters, driveways, sidewalks or any pavement not designated for removal shall be the responsibility of the Contractor to repair or replace to original condition at his expense.

4. Principal roots of trees shall not be cut and the Contractor will be held strictly accountable for any damage resulting from his operations to any trees, shrubbery and/or flowers and must replace or make good at his own cost to the satisfaction of the property owners involved in any such damage. When work crosses maintained lawns, the Contractor shall save, protect, and care for or replace the lawn grass. The top twelve (12) inches of topsoil shall be preserved and replaced across all lawns or other developed areas. The Contractor is urged to take photographs of the job site prior to construction in order to avoid differences in opinion as to the condition of all personal property prior to construction. **Final payment shall not be made until all disputes have been resolved completely.**

5. The Contractor is responsible for the location and verification of all existing utilities. The City of Amarillo has attempted to provide the Contractor with the locations and types of existing utilities on the plans for his convenience. However, the responsibility of actual locations and types of line crossings rest with the Contractor. Any cost incurred by the Contractor due to relocation of utilities shall be at the Contractor's expense.

6. Where excavation endangers adjacent structures and utilities the Contractor shall, at his own expense, support and protect all such structures and/or utilities so there will be no failure or settlement. Where it is necessary to move services, poles, guy wires, pipe lines or other obstructions, the Contractor shall notify and cooperate with the appropriate utility owner. In case damage to an existing structure or utility occurs, whether failure or settlement, the Contractor shall restore the structure or utility to its original condition and position without compensation or compensate the owner of such structure or utility for the damages.

B. **Trench Width and Depth:** The maximum allowable trench width in the pipe zone shall be the outside diameter (O.D.) of the pipe plus twenty-four (24) inches, and the minimum allowable trench width in the pipe zone shall be the outside diameter (O.D.) of the pipe plus twelve (12) inches unless otherwise recommended by pipe manufacturer. The trench walls in the pipe zone shall be vertical. The pipe zone shall be considered as the vertical distance from the bottom of the trench to an elevation one (1) foot above the top of pipe when the pipe is at the specified grade.

Where joints are made, the trench shall be excavated to sufficient depth and width to provide ample space for the joint making operations. Bell holes shall provide adequate clearance for tools and methods used in jointing and installing pipe. No part of any bell or coupling shall be in contact with the trench bottom or trench walls. Excavation for bells shall be provided so that the pipe is uniformly supported along its length. Trenches shall be excavated to a depth such that the pipe can be installed as specified or shown on the plans. The excavation shall leave an undisturbed subgrade upon which to lay the pipe or install bedding. In no case shall the trench be overexcavated more than four (4) inches. All overexcavation shall be backfilled to grade with Class I or II material and tamped to a minimum density of ninety-five (95) percent Standard Proctor Density.

C. **Dewatering:** Trenches shall be dewatered so that pipe laying may be performed on dry ground. Where ground water is encountered, the water table shall be lowered by pumping or other means so that necessary work can be carried on in the dry. The water shall be kept down until the unit or section under construction is completed. Under no circumstances shall water be permitted to flow through or over unset concrete or through the pipeline. All water removed from trenches shall be conducted to natural drainage ways, drains or storm sewers in such a manner as to prevent damage to property or the public. If wet soil is encountered, the wet soil shall be removed and replaced with a Class I or II material thoroughly compacted to grade. The Contractor shall supply pumps of ample capacity to prevent damage to property or the public and to insure that once an excavation is made dry, the water will be kept down until that part of the construction is completed at his cost.

D. **Rock Excavation:** Where rock, cemented gravel, boulders or unyielding shale are encountered in the trench bottom, all such materials shall be removed to a depth of not less than six (6) inches below subgrade for the full width of the trench. The excavation below subgrade in rock or unyielding material shall be backfilled and tamped to proper grade with a Class I or II material. The use of material removed from the trench will not be permitted. The trench shall be backfilled in accordance with the excavation procedure specified herein.

VII. PIPE INSTALLATION

A. General:

1. Minimum cover for all water pipe shall be forty-two (42) inches from the top of the pipe to finished grade or paving unless otherwise shown on plans or directed by the Engineer. The approximate alignment of the pipe is shown on the plans and shall not be changed except at the direction of the Engineer. The Owner reserves the right to make changes in alignment and grade as necessary. No additional compensation will be made for laying and backfilling water pipe at depths greater than forty-two (42) inches or those shown on the contract drawings. Pipe shall be laid up to the ditching machine or back hoe at quitting time every day. The Contractor shall uncover pipe, conduits and utilities when asked to do so. This work may be required prior to issuance of cut cards without additional compensation. The Contractor may lay up to a bore, but may not proceed until the bore has been checked and accepted by the Engineer for use.

2. Trenches shall be excavated so pipes will be laid straight, at uniform grade, without dips or humps between the terminal elevations shown on the drawings. The pipe shall not vary more than one-tenth (1/10) of a foot from true line and not more than two-hundredths (2/100) of a foot from the theoretical grade.

3. Before any pipe or fitting is put in place, its interior shall be free of dirt, trash, and any other foreign matter. A temporary end closure, bulkhead or plug shall be used during periods of time when laying operations are not active so debris, mud, and animals will be prevented from entering the pipe.

4. All installation of pipe shall be in accordance with manufacturer's instructions. Prefabricated joints shall be wiped with a dry cloth to remove grit and moisture. Joint lubricant shall be applied with a brush swab and spread evenly over all surfaces of both joints. The joints of pipe shall be placed together making sure the spigot seals properly and the pipe is firmly in place. Joints of all sizes and types of pipe shall be made in place in the ditch without the aid of mechanical equipment.

B. **PVC Pressure Pipe (PVC):** If subgrade of trench bottom is undisturbed and of acceptable quality to the Engineer, the pipe may be installed directly on the trench bottom, otherwise bedding shall be installed. The following bedding materials and compaction densities shall be used:

Class I	Inplace Density
Class II	85% standard proctor density
Class III	90% standard proctor density
Select Excavated Material	90% standard proctor density

Extreme care shall be taken to provide the full length of the barrel with full bearing. Haunching from the bottom of the pipe to the spring line shall be installed using the same materials and densities specified for bedding. Haunching material shall be hand tamped in-place. Care shall be taken to insure that the material fills all voids and is properly compacted under the pipe. The Contractor shall then install approved backfill material to natural ground as specified herein.

C. **Ductile Iron Pipe (DI):** Unless otherwise specified, ductile iron pipe shall be installed per the following specifications. The bottom of the pipe trench shall be excavated to proper grade and bell holes of suitable size shall be dug at each joint to permit proper jointing. Extreme care shall be made to provide the full length of the barrel with full support. If subgrade bottom is unacceptable to the Engineer or the pipe barrel cannot be fully supported by the trench bottom, the Contractor shall install bedding material specified for PVC pressure pipe. After pipe is laid, select excavated material shall be tamped to the spring line of the pipe filling all voids under pipe.

D. **Concrete Steel Cylinder Pipe (CSC):** Unless otherwise specified, CSC pipe shall be installed per the following specifications. The bottom of the pipe trench shall be excavated to proper grade and bell holes of suitable size shall be dug at each joint to permit proper jointing. Extreme care shall be made to provide the full length of the barrel with full support. If subgrade bottom is unacceptable to the Engineer or the pipe barrel cannot be fully supported, the Contractor shall install bedding material specified for PVC pressure pipe. Once the joint has been engaged, the gasket shall be checked, and the joint shall be mortared both outside and inside the pipe. Once the joint has been completed, select excavated material shall be tamped to the top of the pipe filling all voids under pipe.

E. **Valve Installation:**

1. All valves shall be carefully handled and lowered into position by mechanical equipment in a manner so as to prevent damage to all parts of the valve. Each valve shall be placed in the proper position with the operating stem truly vertical and shall be securely held in-place until all connections have been made.

2. All direct bury butterfly valves shall include a concrete cradle. The cost of the concrete cradle shall be included in the cost of the butterfly valve. The cradle shall be constructed of three thousand (3000) psi concrete and shall be formed upon undisturbed soil. The cradle shall have a minimum thickness of twelve (12) inches and shall extend a minimum of three (3) inches away from the edge along the bottom of the valve. The concrete shall come up past the lowest part of the valve, but shall not encumber any nut or bolt.

F. **Fire Hydrant Installation:** The hydrant shall be installed with the center of the hydrant eighteen (18) inches from back of curb or at the location directed by the Engineer. The hydrant shall be set truly vertical and shall be securely braced with concrete or stone blocks until it is self-standing. It shall be placed on well compacted soil surrounded by a minimum of seven (7) cubic feet of clean gravel or stone to permit free draining of the hydrant. The shoe of the hydrant shall have thrust blocking installed as per the plans without plugging the drain hole of the hydrant.

G. **Concrete Blocking:** Blocking shall rest against undisturbed trench walls. The supporting area of each block shall be at least as great as that indicated on the plans. The blocking shall not encumber any bolts, bolt heads, or nuts.

H. **Replacement of Existing Sewer over New Water Line:** Wherever sewer mains cross above a new water main installation, all vitrified clay or concrete sewer pipe at the crossing shall be replaced by the Contractor with ductile iron pipe or PVC C900 pipe, designed for one hundred fifty (150) psi working pressure. One, approximately twenty (20') foot long joint of the pressure pipe shall be centered on the new water line. The pressure pipe shall have solid bearing on undisturbed earth at least eighteen (18) inches back from both faces of the trench. The jointing and connection of the pressure pipe to the clay or concrete pipe shall be made using transition couplings and then encased in concrete. The cost of the couplings, concrete, labor, and equipment shall be included in the cost of the replacement pipe. Upon completion of the joints, the pipe installed shall be provided with additional intermediate support or supports as directed by the Engineer.

I. **Service Line Crossings:**

1. Wherever water service connections are crossed and the excavation is being done using machinery, service lines are to be removed immediately ahead of the excavation and reset immediately after the excavating machine has passed the service, in order to give the least interruption possible of service to the customer. It shall be the Contractor's responsibility to notify each customer affected and the City amply prior to the time of disconnection of a service. The Contractor shall provide ample support for services across the open ditch. Where the trench is excavated by hand, services are not to be disconnected; however, ample support shall be provided for the services across the open ditch. After completion of the backfilling, services are to be reinstalled to the satisfaction of the Engineer, in a workmanlike manner providing a firm support which will not settle.

2. Services or laterals cut or excessively bent during construction, or where it is necessary to replace same due to their crossing over the main under construction, shall be replaced by the Contractor using necessary adapters and piping to the existing service or

lateral. All materials and costs necessary to make complete repairs, including pipe and fittings, shall be furnished by the Contractor.

3. Cuts or breaks in existing mains, laterals, or connections shall be restored at the earliest practicable moment in order to give the least possible interruption in service. The Contractor shall be responsible for notifying all customers prior to service being disrupted.

J. **Boring of R.O.W.:** All bores shall be checked and approved by the Engineer before their use. Piping may be laid up to the bore from the outfall end, but the laying of pipe may not proceed through the bore until that bore has been checked and accepted for use.

K. **Alternate Bedding:** Contractor may submit an alternate bedding proposal provided the pipe manufacturer supplies written certification of the alternate bedding technique to the City. No extra compensation shall be granted to the Contractor for any approved alternate bedding proposal.

L. **Tapping Sleeves:** All tapping sleeves shall be air tested prior to the tap being made. The tapping sleeve shall be pressurized to 70 psi, held for five (5) minutes at that pressure, and shall show no signs of leakage. Should the air test indicate the presence of a leak, corrections shall be made and the tapping sleeve air tested again until the test will pass.

VIII. TRENCH BACKFILL AND COMPACTION

A. General:

1. As soon as practical after completion of laying and jointing of the pipe, the backfilling of the trench shall begin. After the pipe has been laid and the Engineer's approval obtained as otherwise specified, the trench shall be backfilled with select excavated material and tamped to a level of twelve (12) inches above the top of the pipe. **When the Contractor is installing PVC pipe, the Contractor shall provide and install an acceptable metalized detectable warning tape, blue in color, approximately twelve (12) inches above the top of the pipe, the cost of which shall be included in the price bid per lineal foot of pipe.** Compacted backfill shall be required for the full depth of the trench above the pipe zone in all locations. Compacted backfill shall consist of excavated material free from debris, organic material, frozen material, trash, and stones larger than three (3) inches in greatest dimension. Dust is to be kept to an absolute minimum by sweeping and/or wetting of fill.

2. The top portion of backfill beneath established cultivated, landscaped or sodded areas shall be finished with not less than twelve (12) inches of topsoil. The top soil shall be the top twelve (12) inches of soil and this soil shall be removed and stored in a separate location from the rest of the excavated material, and replaced to as near original condition as possible.

3. Water for compacting the backfill shall be provided by the Contractor at his own expense. Water may be obtained as specified in Subsection 3.04 "Requirements for Water Usage."

4. Backfilling of the trench shall be less than five hundred (500) feet behind the pipe laying operation at all times. The cost of this work shall be included in the cost of the pipe.

5. It is the intent of these specifications that, by good backfill procedures, the backfill will be of such density as to preclude any settlement. The Contractor, upon request, shall refill and/or repair any trench areas which settle within one year after the date of final acceptance of the project.

6. If the depth of the trench over the pipe is greater than eight (8) feet in depth, the Contractor shall provide select excavated material to at least twelve (12) inches above the top of pipe, tamped in place before beginning backfill procedure.

B. **Tamping Method:** Care shall be exercised in mechanically compacting the first lift to insure that the backfill used shall be placed in lifts not to exceed an eight (8) inch depth, wetted to approximately optimum moisture content, compacted with optimum moisture content with pneumatic, vibratory or other approved mechanical tamps. Additional lifts shall not be placed until the lift being compacted has attained a density of at least ninety (90) percent of Standard Proctor Density. If necessary for maximum compaction, water must be added at the Contractor's expense.

C. **Water Jetting Method:**

1. All backfill material shall be compacted and the Contractor at his discretion, may use either the pneumatic tamp method in eight (8) inch lifts or the pressure jetting with water method. If the jetting method is used, the first and subsequent lifts shall not exceed ten (10) feet and shall be thoroughly jetted before additional backfill is placed. When the first lift is jetted, the Contractor shall take extreme care not to disturb the bedding material under and around the sewer pipe with the jetting pipe and pressurized water. Pressure jetting shall continue in each lift until that lift is completely saturated.

2. The equipment for pressure jetting shall be equal to a fire hose having a length of three-fourths (3/4) inch diameter or larger pipe attached to the end, which can be inserted down into the backfill while large quantities of water are being forced through the pipe under pressure. The source of water should preferably be a tank truck equipped with a pump for supplying large quantities of water under pressure. The jet pipe shall be inserted at six (6) foot **maximum** intervals, and sufficient water shall be injected, and there will be no bridging across or dry areas.

D. **Backfilling Around Structures:** Excavations around structures shall be backfilled with excavated or other material to the elevation shown on the plans. Backfill material shall be select material free from rock or boulders measuring more than three (3) inches in their greatest dimensions. Normally, the backfill material may be dumped or pushed into the excavation and stabilized by flooding and jetting. However, where directed by the Engineer, the backfill material shall be placed in layers, not exceeding six (6) inches in thickness, by hand or pneumatic tamping until the backfill is the same density as the undisturbed earth in the sides of the excavation.

E. **Backfilling Trenches (Other than R.O.W.):**

1. Except as specified for backfilling trenches in existing paved streets or in rock, where approved backfill is required, trenches shall be backfilled using materials excavated from trenches if the excavated material meets the specifications for Approved Backfill.

2. After the pipe has been laid and the Engineer's approval obtained as otherwise specified, the trench shall be backfilled with select excavated material and tamped to a level of twelve (12) inches above the top of the pipe. The backfill material shall be placed in layers not exceeding four (4) inches in thickness and tamped on both sides of the pipe for the full width of the trench. Tamping shall be thoroughly done on each side of the pipe and under the pipe to secure firm contact between backfill material and the outside pipe

surface. Backfilling with hand or pneumatic tamping shall be continued until the pipe has been completely backfilled to a height of twelve (12) inches above the top of the pipe.

3. As an alternate, compaction in the pipe zone may be done by jetting under the proper pressure with water. The Engineer must approve this method both before it is commenced and also while in progress. Select excavated material shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench and to the spring line of the pipe. The backfill shall then be jetted with sufficient water under the proper pressure to cause the fill material to "melt together", thereby filling all the voids under and around the pipe. Additional select backfill shall be placed simultaneously on both sides of the pipe to an elevation of twelve (12) inches above the pipe. This backfill shall be compacted and settled by the jetting method described above. Where jetting is done, the jet nozzle shall be inserted into the fill at six (6) foot maximum spacings to preclude any possibility of "bridging" between points where the nozzle is inserted. Care shall be taken not to float the pipe during the process. Any pipe which has been "floated" shall be taken up, the ditch reworked, and the pipe relaid to the proper grade, all at the Contractor's expense.

Except in roadways or across streets and highways, the balance of the backfill will be water jetted. Water for compacting the backfill will be provided by the Contractor at his own expense. Water may be obtained as specified in Subsection 3.04 "Requirements for Water Usage."

No rock shall be placed in the backfill. Where such rocks or boulders occur in the soil bank, non-selective backfilling with bulldozers or other mechanical equipment will not be permitted.

F. Backfilling Trenches (R.O.W.):

1. Where the trench lies in or across County roadways or City streets, the backfill above the pipe zone shall be made with an approved material, to be placed in uniform layers of six (6) inches maximum thickness and each layer will be compacted to a density equal to the adjacent undisturbed soil. To obtain the proper density the backfill material may be moistened. State Right-Of-Way shall be backfilled in the same manner unless noted otherwise.

2. At the Contractor's option, trench excavation in or across existing City streets may be backfilled with sand, approved by the Engineer, above the pipe zone. If there is to be a lapse of time between backfilling the trench and installation of the base material, the excavation in the street may be backfilled with sand to the bottom of the base material to be placed, or to the grade of adjacent paving.

3. Sand backfill shall be placed in layers not to exceed twelve (12) inches in depth and each layer shall be moistened sufficiently to uniformly settle the layer of sand before the next layer is placed in the trench. There will be no extra reimbursement to the Contractor for sand backfill used in street excavations.

G. Backfill in Fields and Pastures:

1. Cultivated fields shall be backfilled in such a manner as to leave the fields in a good state of cultivation. All rock, caliche, and other debris shall be removed at the Contractor's expense. Terraces shall be backfilled in such a manner that the original grade will be maintained after settlement. Cultivated fields shall be left in a condition equal to or better than original.

2. Pastures will be left in a condition equal to or better than it existed before construction. Care shall be taken to minimize damage to grass or other vegetation.

H. **Backfilling Trenches in Rock:** When excavated materials from a trench in rock or loose rock is composed largely of rock fragments which will not pass through a one (1) inch mesh sieve, such material shall not be used for backfilling within the pipe zone to a level twelve (12) inches above the top of the pipe, but, in lieu thereof, sandy backfill shall be used. Above the pipe zone, except as specified for sand backfill, the remainder of the trench may be backfilled with excavated material as set forth for earth backfill, provided, however, that no rock fragments with a dimension larger than three (3) inches shall be used in the backfill.

IX. RESTORATION OF SURFACES

The Contractor shall replace all surface materials and restore fencing, sod, and other surfaces to a condition equal to or better than the condition before the work began.

X. SURPLUS EARTH

Surplus excavated materials from all excavations shall be disposed of by the Contractor at his expense.

XI. CLEAN UP

The Contractor shall remove all surplus pipeline materials, tools, equipment, scraps, broken pipe, debris, rubbish and temporary structures. The Contractor shall leave the construction site in a first class workmanlike manner, to the satisfaction of the City. Clean up shall be no more than two thousand (2000) feet behind pipe laying operations, or as otherwise directed by the City.

LAST PAGE OF THIS SUBSECTION

SUBSECTION 6.04
HYDROSTATIC TESTING OF WATER LINES

I. GENERAL

A. After the pipe has been laid, blocking has cured sufficiently, and backfilled, each valved section of newly laid pipe shall be subjected to a hydrostatic pressure test. For any section being tested, the pressure applied shall be such that at the lowest point in the section the pressure shall be one hundred fifty (150) psi unless specified otherwise. Tests may be conducted between Monday and Friday except on holidays. **All tests must conclude by 5:00 p.m.**

B. Each valved section of pipe shall be **slowly** filled with water to the specified test pressure, measured at the point of lowest elevation. The pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, and all necessary apparatus including gauges and meters shall be furnished by the Contractor at his expense.

II. PROCEDURE

A. The Contractor may test the pipeline in sections when all concrete blocking in the section to be tested is at least seven (7) days old unless approval is given otherwise by the Engineer. Care shall be used to see that all air vents are open during the filling of the line and all air shall be expelled from the line prior to the pressure test. After the line has been completely filled, it shall be allowed to stand under a slight pressure for a minimum of forty-eight (48) hours to allow the lining to absorb what water it will and to allow the escape of air from any air pockets. During this period, the project shall be examined for leaks. The water necessary to maintain the test pressure shall be measured through a meter or by other means satisfactory to the Engineer.

B. The duration of the test shall be four (4) hours and the line shall be repressurized at both thirty (30) minute intervals and when the line pressure falls to one hundred (100) psi. During the last two (2) hours of the test, the entire route of the pipe line shall be inspected for leaks or breaks. Any and all leaks shall be repaired and all defective materials removed and replaced with sound material and the test completely repeated until satisfactory results are obtained.

III. ALLOWABLE LEAKAGE

A. General:

The pipe line shall not be accepted by the City until the line has passed the pressure test without exceeding the amount of allowable leakage as specified herein. The amount of leakage is defined as the quantity of water needed to maintain the required pressure on the pipe line for the full duration of the test after the test is begun.

B. Cast Iron and Ductile Iron Pipe:

The allowable leakage is defined as, $L = \frac{S*D*P^{0.5}}{133,200}$ where:

L = allowable leakage, in gallons per hour
S = length of pipe tested, in feet
D = nominal diameter of the pipe, in inches
P = average test pressure during the test, in psi (gauge)

This formula comes from AWWA Standard C600, pp. 17-19.

C. **Polyvinyl Chloride (PVC) Pipe:**

The allowable leakage is defined as, $L = \frac{N*D*P^{0.5}}{7400}$ where:

L = allowable leakage, in gallons per hour
N = number of joints in the length of pipeline tested
D = nominal diameter of the pipe, in inches
P = test pressure during the test, in psi (gauge)

Allowable leakage per 1000 Feet of Pipeline - gph

Pipe Diameter (Inches)	150 psi Test Pressure at Lowest Point
6	0.50
8	0.66
10	0.83
12	0.99

This formula comes from the Uni-Bell PVC Pipe Association Handbook of PVC Pipe - Design and Construction, p. 286.

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SUBSECTION 6.05
WATER SERVICE LINE REPLACEMENTS

I. GENERAL

A. ANSI/NSF Standard 61: All pipes and related products used in the City of Amarillo potable water system shall meet TAC 30 Chapter 290 of the TCEQ Rules and Regulations for Public Water Systems.

B. Taps: All taps with a one (1) inch or smaller meter shall be replaced with one (1) inch fittings from the main through the meter. Taps one and one-half (1½) inch and two (2) inch are to be installed as a two (2) inch service except at the meter a two (2) by one and one-half (1½) inch brass bushing shall be used to reduce to the smaller meter. Meter settings shall be installed perpendicular to the water main from which the tap was made with the curb stop operator handle on the right hand side when facing the house from the alley or street.

C. Meter boxes: Existing meter boxes shall be used unless they are broken. Existing installations which have broken meter boxes shall have the meter box provided by the City and installed by the Contractor. The Project Representative shall make arrangements at the Service Center for new meter boxes as needed. It shall be the responsibility of the Contractor to pick up and deliver the meter boxes to the job site.

The following is a list of the parts which shall be used on **all** service replacements and new services for the various meter service sizes shown. Ford and/or Mueller part numbers are provided, substitutes must be approved prior to installation.

II. 1" SERVICE LINES (METER SETTINGS)

A. Existing Services (Existing Subdivisions) 1" Hardware List:

1. Bronze Tap (Service) Saddle with double flat silicon bronze straps, bronze nuts, and CC threads. (Mueller: 6" BR2B0684CC100; 8" BR2B0899CC100; 10" BR2B1104CC100; 12" BR2B1314CC100; Ford: Style 202B).

2. Bronze corporation Stop: Inlet - CC thread; Outlet - flare copper tubing or CTS compression. (Mueller H-15000 or H-15008; Ford F600-45 or F1000-4-Q).

3. Service pipe, inlet and outlet, shall be continuous one (1) inch type K soft copper. (No splicing allowed).

4. Bronze Teflon Coated Ball Valve Curb Stop: Inlet - flare copper tubing connection or CTS compression; Outlet - FIP thread; body, tee head operator, three hundred sixty degree (360°) ball rotation, full size round port opening, padlock wings (Ford B21-444WR , B41-444-WR-Q or Mueller 300 Curb Valve B-25170-3).

5. Inlet Bronze Meter Coupling, ninety degree (90°) bend: inlet - standard meter coupling nut; Outlet - MIP thread (Mueller H-10892 or Ford L38-44).

6. Angle Meter Coupling: 90° bend: inlet - standard meter coupling nut; outlet - flare copper tubing or CTS Compression (Mueller H-14200, Mueller H-1406 or Ford L34-44-Q).

7. Bronze Pack Joint Straight Coupling: Inlet - flared copper tubing or CTS Compression; outlet - pack joint coupling. (Ford C47-44-Q or Mueller H-15409 when connecting to plastic schedule 40; Ford C44-44-Q or Mueller H-15403 when connecting copper to copper; others as approved).

Note: When connecting to a three-fourths (3/4) inch meter, a one (1) inch by three-fourths (3/4) inch brass bushing shall be used in the ball valve. All fittings after the bushing will be three-fourths (3/4) inch.

B. New Services (New Subdivisions) 1" Hardware List:

1. Bronze Tap (Service) Saddle with double flat silicon bronze straps, bronze nuts, and CC threads. (Mueller:6" BR2B0684CC100; 8" BR2B0899CC100; 10" BR2B1104CC100; 12" BR2B1314CC100; Ford: Style 202B).

2. Bronze corporation Stop: Inlet - CC thread; Outlet - flare copper tubing or CTS Compression (Mueller H-15000 or Mueller H-15008; Ford F600-45 or Ford F1000-4-Q).

3. Service pipe, inlet and outlet, shall be continuous one (1) inch type K soft copper. (No splicing allowed).

4. Bronze Teflon Coated Ball Valve Curb Stop: Inlet - flare copper tubing connection or CTS Compression; Outlet - FIP thread; body, tee head operator, three hundred sixty degree (360°) ball rotation, full size round port opening, padlock wings (Ford B21-444WR, Ford B41-444-WR-Q or Mueller 300 Curb Valve B-25170-3).

5. Inlet Bronze Meter Coupling, ninety degree (90°) bend: Inlet - Standard meter coupling nut; outlet - MIP thread (Mueller H-10892)

III. 1-1/2" AND 2" SERVICES (METER SETTINGS)

A. Hardware List:

1. Full Circle Tapped Service Clamp: All stainless steel construction with rubber gasket material: tapped with cc thread; six (6) inch and eight (8) inch mains use two (2) piece clamp. Ten (10) inches and larger use three (3) piece clamp or Ford 202 BS double band saddle.

2. Bronze Ball Valve Corporation Stop: Inlet - CC thread; outlet - 2" C.T.S. Quick Joint (Ford FB-1000-7-Q; Mueller H-15013).

3. PE CTS Tubing - use solid stainless steel inserts at all compression connections. (Installation procedures are in Subsection 6.02 section V of this manual.)

4. Bronze Ell Coupling, ninety degree (90°) bend: Inlet - PE CTS compression connection; Outlet - MIP thread.

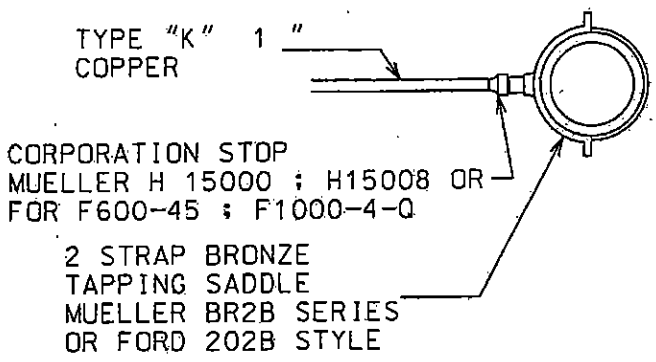
5. One Class 150 Bronze Gate Valve: Rising stem, solid wedge, iron or brass operating wheel, inlet and outlet FIP thread. (Nibco T-134; Milwaukee 1150)

6. Brass Pipe: Length varies, for connection from gate valve to meter flange connection, MIP thread both ends.

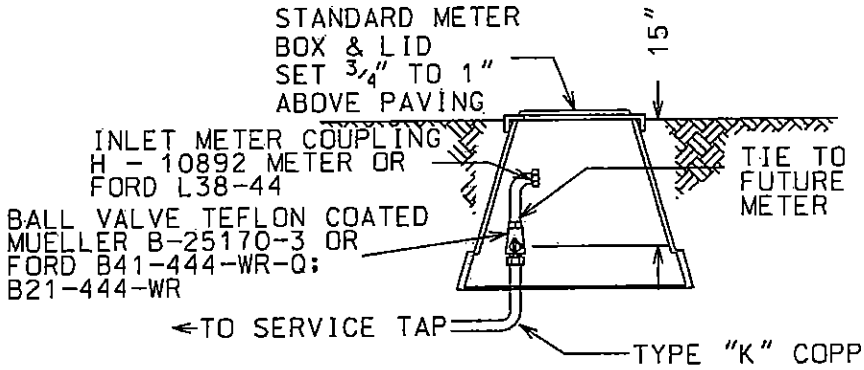
7. Meter Flange Hardware: Stainless steel bolts, stainless steel washers, brass or stainless steel nuts, fabric reinforced (V & S, non-cotton) neoprene gaskets.

B. Reduced Meter Settings: When reduced meter settings arise, all bushings shall be brass.

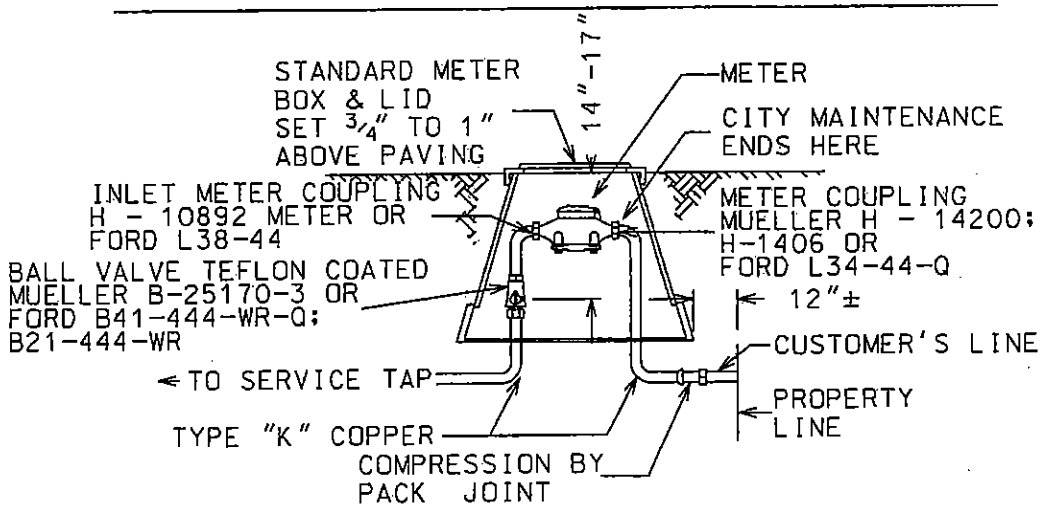
C. Bronze Meter Flange: FIP thread x meter flange, two (2) each flanges and hardware per normal setting. If approved by City, an approved flexible meter coupling with stainless steel bolts and brass nuts may be used on the outlet end of a meter where an alignment problem occurs.



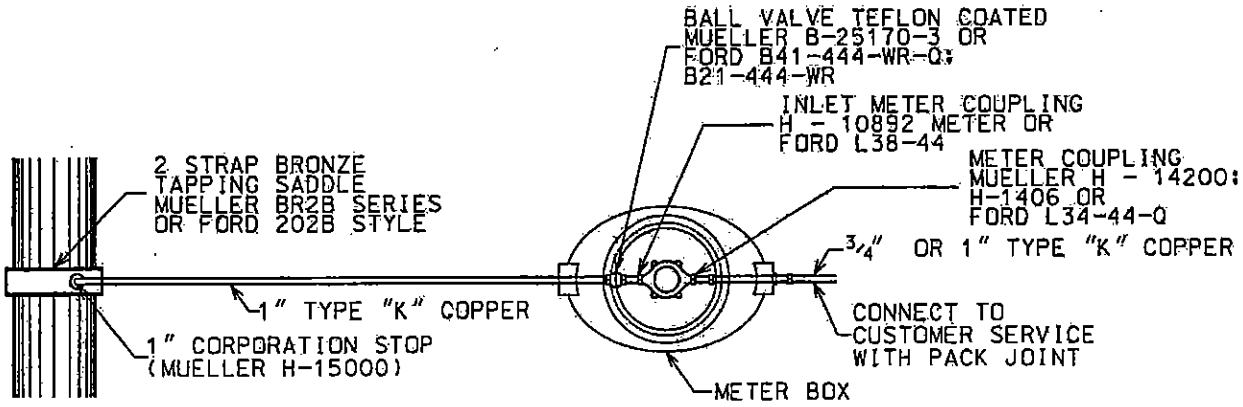
SERVICE TAP 6" - 12" PIPE



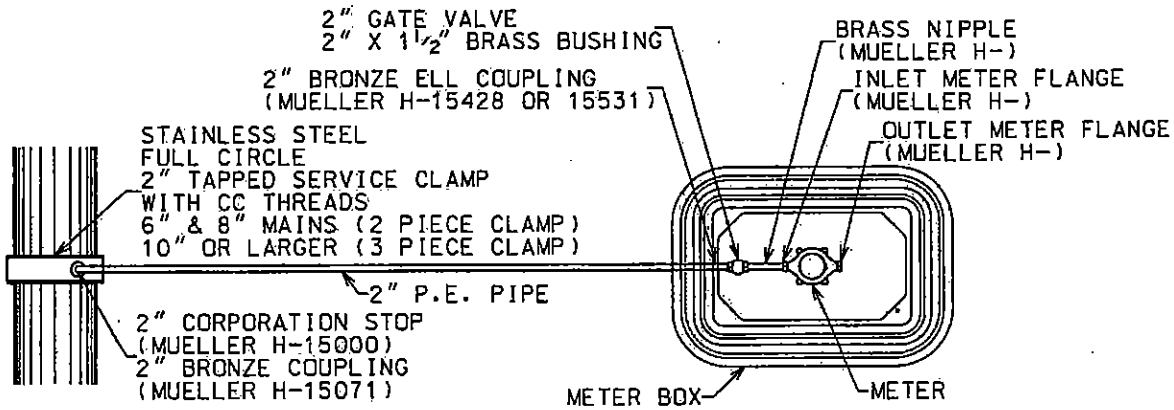
DETAIL FOR FUTURE HOUSE



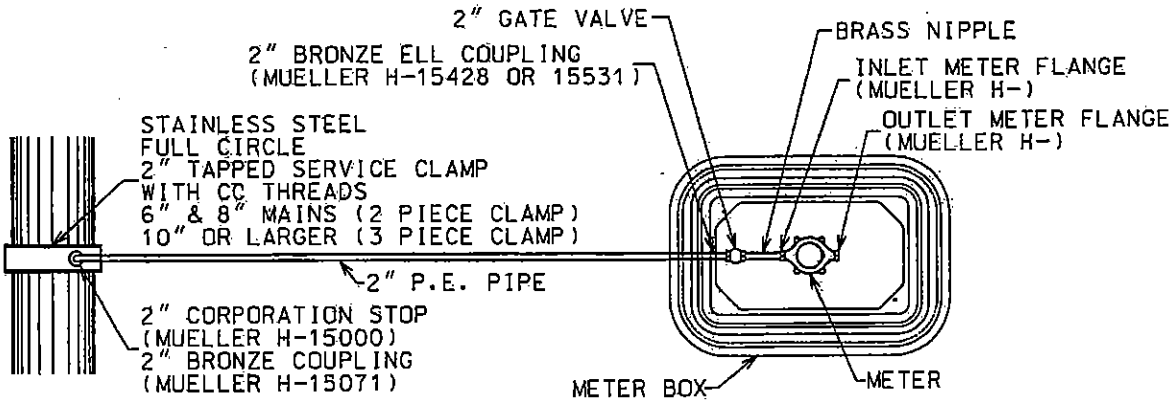
DETAIL FOR EXISTING HOUSE



1" TAPS



1 1/2" TAPS



2" TAPS

WATER SERVICE TAP DETAILS
PLAN VIEW

LAST PAGE OF THIS SUBSECTION