SECTION 3

WATER MAIN, VALVES, HYDRANTS AND APPURTENANCES

12/08/2015

CITY OF KEARNEY
HEART OF NEBRASKA

STANDARD CONSTRUCTION SPECIFICATIONS

Chapter 3 - WATER MAIN, VALVES, HYDRANTS AND APPURTENANCES

3.00 SCOPE

This specification is intended to define and/or limit the required quality standards of the materials furnished and the workmanship performed in connection with herein specified items of piping, fittings, valves and hydrants with all the required accessories and/or appurtenances, including in part: all labor, tools, materials and equipment for the complete work of this project which are in accordance with this specification and the applicable drawings.

3.10 GENERAL

The Contractor shall remove paving, as may be required, excavate the trenches and pits to the required dimensions; excavate bell holes; and maintain all streets and bridges for traffic control; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or groundwater; provide barricades guards and warning lights; lay and test pipe, castings, fittings, valves, hydrants and accessories; backfill and consolidate the trenches and pits; restore the roadway surface unless otherwise stipulated; supply required or remove surplus excavated material; and clean the site after the work.

Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure, complete and compatible installation shall be furnished and installed as part of this work. The drawings show sizes and general arrangement of all pipes and appurtenances. Responsibility for handling and/or cutting exact lengths of pipe for proper make-up rests with the Contractor.

The work shall comply with the current requirements of the American Water Works Association (AWWA). Water distribution system installation must comply with State of Nebraska Department of Health and Human Services Standards. All chemicals utilized for water main construction shall be NSF 60 approved, and all materials shall be NSF 61 approved.

3.20 MATERIALS

3.21 WATER MAIN MATERIAL

A. DUCTILE IRON PIPE – All mechanical joint, push-on, or restrained ductile iron pipe (D.I.P.) shall be thickness Class 50 for 16 inch diameter and smaller and pressure Class 350 for pipe larger than 16 inch diameter, meeting AWWA Standard Specifications C-150 and C-151. All ductile iron pipes shall have a standard thickness interior cement lining conforming to the requirements of AWWA Standard Specification C-104 and an exterior coating of bituminous material approximately one mil thick except for exposed pipe scheduled to be painted.

All joints shall be either push-on type with single vulcanized rubber gaskets or mechanical (gland type), unless otherwise specified, meeting AWWA Standard Specification C-111. Vulcanized rubber gaskets shall be visually free of defects and areas of foreign materials. When indicated, flanged joints shall be cement lined and shall conform to AWWA Standard Specification C-115. Gaskets shall be 1/8 inch thick.

Polyethylene Encasement for gray and ductile iron piping shall be furnished and installed according to AWWA C-105, Methods A or B. Repair all rips, punctures or other damage to the polyethylene with adhesive tape or short length of polyethylene tube cut open wrapped around the pipe and secured in place. All fittings and valves shall also be covered and wrapped in accordance with manufacturer's instructions.

B. FITTINGS – Fittings shall be mechanical joint conforming to AWWA Standard Specification C-153, C-104 and C-111. Fittings shall be formed from ductile iron and rated for 350 psi working pressure. Caps, plugs and miscellaneous fittings shall be provided conforming to AWW Standard Specification C-110. Bolts and nuts shall be an alloy steel conforming to ASTM A194. Provide polyethylene encasement on all water main fittings and valves in full compliance with AWWA C-105.

C. FIRE HYDRANTS – Hydrants furnished shall conform to the requirements of the AWWA Standard Specification C-502. Hydrants shall open to the left (counter-clockwise) unless otherwise specified. Hydrants shall be designed to operate under 150 psi (10.5 kg/sq. cm) working pressure and tested at 300 psi (21.0 kg/sq. cm).

All water passages shall be of such form and size as to permit the full flow of water without undue loss by friction. Hydrants must have a positive drain, which will allow the water to escape readily from the standpipe when the hydrant valve is closed, but said drain opening must be closed as soon as the hydrant valve is partially opened. The valve stem and valve shall be removed without the necessity of exposure of the hydrant by excavation. Hydrants shall be suitable for the depth of the trench. Bury Depth of the fire hydrant shall be 5 ½ feet unless otherwise specified. If the elevation of a hydrant must be adjusted to conform to the finished grade, hydrant extension kits and grade locks will be allowed. Hydrant extension kits shall be of the same manufacture as the hydrant, no universal aftermarket kits will be allowed. All fire hydrant extension kits shall be provided to the City of Kearney Utilities Department for installation. All hydrants shall have a 5 ¼ inch (13.3 cm) valve opening, two 2 ½ inch (6.3 cm) hose nozzles and one 4 ½ inch (11.4 cm) steamer nozzle with the National Standard hose coupling thread, 6 inch (15.2 cm) mechanical joint inlet, and shall be Mueller Cat. No. A423 or American Darling B-84-B

Hydrant area shall be painted the following colors:

- Bonnet and all hose caps shall be safety yellow
- Barrel and remainder of hydrant shall be red to bury line
- Bury line and below shall be black.

D. VALVES – Valves shall be furnished as follows:

(1) Valves 16 in. diameter and smaller to be resilient seat gate valves
(2) Valves 18 in. diameter and larger to be butterfly valves
(3) Gate valves shall meet AWWA C-509 and or contain a brass stem
(4) End connections as shown or drawings which are compatible with connection joint
(5) Shop drawings indicating valve pressure, flange rating valve body material valve trim, operator, internal lining material, dimensions, class, flow coefficients, etc.
(6) Handwheels for all exposed piping, valves with arrow and "OPEN" work casting impression.

Valves shall be installed according to manufacturer's directions. Valves shall be supported in such a way to minimize bending of the end connections. Operating wrench shall be able to free operating valve. The operating nut location, when not over the main, will be to the north or west of the main.

a) VALVES

(1) ***Gate Valves -*** shall be resilient seat valves and shall comply with the requirements of the AWWA Standard Specification C-509. Valves shall have hub ends to fit the pipe for which they are to be used. An adjustable valve box of sufficient length for the depth of trench shall be furnished complete. All gate valves shall have a clear waterway of the full diameter of the valve and shall be opened by turning to the left. The operating nut shall have cast thereon an arrow indicating the direction of the opening. Each valve shall be designed for a maximum working pressure of 200 psi (14 kg/sq. cm). Prior to shipment from the factory, each valve shall be tested by hydraulic pressure equal to twice the working pressure. Unless otherwise specified, valves shall be resilient seat non-rising stem. Valves shall have "O" Ring packing and a 2 inch (5.1 cm) operating nut. Valve disc and entire inside of valve body shall be coated with a two part thermosetting epoxy coating, complying with AWWA C-550. The number of turns to open shall be approximately 3 times the pipe diameter of the valve plus a maximum of 2-3 turns. Valves shall be Mueller or American Darling or equal as approved by the city's Utilities Department.

(a) If operating nut is greater than 6.5 feet to surface, Contractor shall provide extension to get within 5' of valve box lid.

Butterfly Valves - Valves shall comply to AWWA Standard Specification C-504, Rubber Sealed Butterfly Valves. Direct burial valves shall be minimum Class 150B with body construction conforming to ASTM A126 Class B or ASTM A536, Grade 65-45-12 ductile iron. Stainless Steel Shafts of 18-8 Type 304 or 316.*Unless specifically scheduled or noted, furnish valve discs for potable water and similar applications. Use ASTM A48, Class 40 Cast Iron; ASTM A526, Grade 65-45-12 ductile iron; ASTM A436, Type 1 alloy cast iron or bronze in accordance with AWWA C504.*

Design valve seats to be fully compatible with valve body in accordance with valve class in accordance with AWWA C504. Unless specifically scheduled or noted otherwise, furnish valve seats for potable water applications. Use synthetic rubber seat material in compliance with AWWA C504. For valves 30 in. and larger, furnish mating metal seat surface constructed of stainless steel ASTM A276, 18-8 material.

Provide valve bearings and shaft seals in full compliance to AWWA C504. Buried Valve Operators shall have a square operating nut.

The valve shall be DeZurik or Henry Pratt, Groundhog buried Service Rubber Seated Butterfly Valve, Class 150B service and be manufactured in accordance with the latest revision of AWWA C504 with seat in body. All internal and/or external surfaces shall be covered with a polyamide cured epoxy coating applied over a sand blasted "new white metal surface" per SSPC-SP10 to a minimum of 6 mils in compliance with AWWA C550.

E. VALVE BOXES – Valve boxes shall be constructed of cast iron or metal with a 3/16 inch (0.05 cm) minimum thickness at any point. The cover shall have cast thereon the word "WATER" and shall be Tyler domestic or equal. Two piece, Buffalo Type valve boxes shall be equivalent to Mueller screw type H-10360. Valve boxes shall be screw type size 666-S or approved equal. If valve boxes are not located in PCC paving (street, sidewalk, or driveway) a PCC pad shall be poured at the finished grade surface. If the valve box is located in a gravel or asphaltic street or driveway, the pad shall be 8 inches thick and 2.5 feet in diameter. If the valve box is located behind the back of curb in a grassed area the pad shall be 4 inches thick and 1.0 feet in diameter. Backfill around valve boxes shall be existing soil or approved backfill, do not backfill with PCC. Valve box shall be centered over operating nut. All valve boxes shall be installed upon the valve with the use of the Multi-Fit Adaptor as manufactured by Adaptor Inc. or an approved equal and installed according to manufacturer's specifications. All valve boxes shall be in accordance with the City of Kearney's Standard Valve Construction Detail.

F. TAPPING TEES AND VALVES – Tapping tees shall be all stainless steel with stainless steel nuts and bolts and equal to Ford Fast Tap FTSS or Mueller H-304SS and shall be furnished and installed as required by the drawings. Valves shall be as previously specified. Valve boxes shall be as previously specified.

G. COUPLINGS – Compression Sleeve Couplings. Furnish and install flexible compression-sleeve type coupling. Incorporate units conforming to the following criteria.

(1) Use compression sleeve couplings equal to Ford Style FC 1-ESH.
(2) Provide sleeves constructed of carbon steel having a minimum yield of 300,000 psi. Insure ends are smooth inside tapered for uniform gasket seating.
(3) Provide followers made of malleable iron ASTM A47 Grade 35018 or 32510 or Ductile Iron ASTM A536.

(4) Provide gaskets of special compound or GRS rubber with no reclaimed materials and with good resistance rating for service intended.
(5) Install stainless steel nuts and bolts.
(6) Finish cast parts with epoxy coating.

Install coupling to allow space of not less than ¼ inch but not more than 1 inch.

3.22 WATER SERVICES

A. COPPER TUBING – Seamless copper tubing shall conform to the applicable requirements of Federal Specification WW-T-799a, "Type K" for service lines 1 to 2 inches (1.9 to 5.1 cm) in diameter. Backfill around copper water service lines shall be existing material, do not backfill with gravel or other abrasive material unless approved by the Engineer.

B. CORPORATION STOPS – Corporation stops shall comply with AWWA Standard Specification C-800. Corporation stops shall have AWWA taper or Mueller thread on the inlet end, with copper service couplings for connections to the service lines. The corporation stops shall be Mueller B-25008 or Ford FB-1000-4-Q. All connections to the main shall be electrically insulated by means of approved insulating fitting if specified. . The corporation stops shall be 300 psi pressure rated and shall meet the no lead requirements.

C. TAPPING SADDLES – Tapping saddles shall be brass double strap saddles with threads compatible with corporation stops. Saddles will be Ford 202B Mueller BR2B, or approved equal with maximum working pressure rating of 200 psi.

D. CURB STOPS AND BOXES – Service stops shall comply with AWWA Standard Specification C-800. The stops shall be equal to Mueller Oriseal 110 conductive compression connection B-25163N, 1- inch. Curb stops for 2 inch services shall be Mueller A-2360 thread by thread with plastic threaded plug.

The box shall be equal to Mueller H-10300 with tapped 2" Minneapolis thread for services to 1" and H-10336 for services larger than 1" up to 2" or approved equal. The box shall rest on a cast iron foot piece, brick or other solid support and contain stationary rods. Wood will not be allowed as a permanent solid support. All 2" valves shall have a valve box as stated in section 3.21 "Valve Boxes" of this standard specification. **E**xtension service boxes of the required length and having either screw or slide type adjustment, shall be installed at all service box locations and to the finished grade. The boxes shall have a housing of sufficient size to completely cover the service stop and shall be complete with identifying covers.

3.23 FIRE SERVICE LINES

A. DUCTILE IRON PIPE – All fire service lines material shall conform to Section 3.21 Water Main Material from the tap into the City's water main to the post indicator valve or the city's shut off valve.

B. DOMESTIC WATER SERVICES - All domestic water service lines shall conform to Section 3.22 Water Services and shall be tapped on the street side of the post indicator

valve or the city's shut off valve. Each domestic water service shall have a curb stop installed within 5.0' of the corporation stop tapped into the fire service line.

3.30 CONSTRUCTION METHODS – The installation of the water main shall conform to the piping manufacturer's recommendation and according to the latest revisions of AWWA C-600. The pipeline shall be constructed in a trench which allows 6 foot (1.83 m) minimum cover or as indicated on the drawings, between the top of the pipe and finished grade. At ditch crossings there shall be 5 foot (1.53 m) of cover at the flow line of the ditch. The size of pipe to be installed shall be indicated on the drawings.

Pipe, fittings, valves and accessories shall be handled in such a manner to insure installation of materials in a sound and undamaged condition, and will conform in all respect to specified requirements. Particular care should be taken not to injure the pipe and lining of cast iron and ductile iron pipe.

Equipment, tools and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that no damage is done thereto or to lining therein. Hooks used for insertion in ends of pipe shall have broad, well padded contact surfaces and shall be of such design and length that they will provide uniform support for a distance back from the end of the pipe of not less than one-third of the internal pipe diameter.

Cement lining in pipe or fittings which is broken or loosened in unloading or subsequent handling shall be sufficient cause for rejection of the pipe or fittings containing such damaged and loosened lining. Although defective linings may be repaired by and at the expense of the Contractor who may employ the pipe manufacturer to make such repairs, all repairs shall be made under the direct supervision of a representative of the pipe manufacturer.

All pipe or coating which is damaged shall be removed from the site at the Contractor's expense.

3.31 EXCAVATION, TRENCHING, BEDDING AND BACKFILLING – Excavation, trenching, bedding and backfilling shall conform to Section 6 of this specification.

3.32 WATER MAIN INSTALLATION

A. LOWERING OF WATER MAIN INTO TRENCH – Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient performance of the work. All pipe, fittings, valves and hydrants shall be carefully lowered into the trench piece-by-piece by means of derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to water main materials and protective coatings and linings. Under no circumstances shall water main materials be dropped or dumped into the trench. If damage occurs to any pipe, fitting, valve, hydrant or water main accessories in handling, the damage shall be immediately brought to the attention of the Engineer. The Engineer shall prescribe corrective repairs or rejection of the damaged items.

B. INSPECTION BEFORE INSTALLATION – All pipe and fittings shall be carefully examined for cracks and other defects while suspended above the trench immediately before installation into final position. Spigot ends shall be examined as this area is most

vulnerable to damage from handling. Defective pipe or fittings shall be laid aside for inspection by the Engineer, who will prescribe corrective repairs or rejection.

C. CLEANING OF PIPE AND FITTINGS – All lumps, blisters and excess coating shall be removed from the bell and spigot end of each pipe, and the outside of spigot and the inside of the bell shall be wire brushed and wiped clean, dry, and free from oil and grease before pipe is laid. Dirt and other foreign material must be removed from the barrel of pipe before it is laid.

D. PLACEMENT OF PIPE – Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in the line. The Engineer shall require a heavy, tightly woven canvas bag of suitable size to be placed over each end of the pipe section if placement is hampered by the entrance of soil into the pipe barrel. Canvas bags shall be removed at the time of connection to adjacent pipe. During laying operations, no debris, tools, clothing or other material shall be placed in the pipe. Pipe lines or runs intended to be straight shall be laid so. Deflections from a straight line or grade, made necessary by vertical curves and horizontal curves or offsets, shall not exceed the amount of deflection recommended by the pipe manufacturer. The Engineer is the only one who shall make the determination to change the alignment or grade. If an obstruction is encountered, the water main shall be lowered by means of a fitting, if the grade changes in excess of 2 vertical feet. A grade change of less than 2 vertical feet shall be corrected by installing pipes at uniform grades with high and low areas located at fire hydrant locations.

If the specified or required alignment requires deflection in excess of those stipulated above, the Contractor shall provide either special bends as approved be the Engineer, or pipes in shorter lengths; in such length and number, that the angular deflection at any joint, as represented by the specified maximum deflections are not exceeded. As each length of pipe is placed in the trench, the spigot end shall be centered in the bell and the pipe forced into place with slow and steady pressure without jerky or jolting movements and brought to correct line and grade. The pipe shall be secured into place with approved backfill material tamped under it except at the bells. Precautions shall be taken to prevent dirt from entering the joint space. No wooden blocking shall be left at any point under the pipeline. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer.

E. CUTTING OF PIPE – The cutting of pipe for fittings and closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or cement lining to leave a smooth end at right angles to the horizontal axis of the pipe. The cutting method used shall be approved by the manufacture's specifications and by the Engineer prior to any cuts.

F. BELL ENDS TO FACE DIRECTION OF LAYING – Pipe shall be laid with the bell ends facing in the direction of laying, unless directed otherwise by the Engineer. Where pipe is laid on a grade of 10% or greater, the laying shall start at the bottom and shall proceed upward with bell ends of the pipe upgrade.

G. UNSUITABLE CONDITIONS FOR LAYING PIPE – No pipe shall be laid when, in the opinion of the Engineer, trench conditions are unsuitable. Under no circumstances shall the pipe be laid in water. The contractor shall furnish all necessary equipment, labor and materials for pumping or otherwise removing any water that may enter or

accumulate in the trenches or other excavations and keep them free from water until all work is constructed and set for sufficient time so water will not damage the work in any way or manner.

H. BRIDGING OF PIPE – Concrete bridging may be required by the Engineer under certain conditions. The Engineer shall determine the size and location of concrete bridging to avoid settlement of the pipe being installed or settlement of existing underground utility pipes. This condition shall also apply to other underground utilities being installed over existing water mains. In certain instances, the Engineer may require the complete encasement of water mains by concrete. The size and location of these encasements shall be determined by the Engineer.

I. INSULATION BETWEEN DIFFERENT METALIC PIPE MATERIALS – Wherever it is necessary to join cast iron pipe with pipe or fittings of dissimilar metal, a method of insulating against the passage of electric current shall be provided and shall be approved by the Engineer.

3.33 GENERAL REQUIREMENTS OF PIPE JOINTING – The requirements already set forth shall apply in addition to installation of joints in accordance with pipe manufacturer's recommendations approved by the Engineer.

A. MECHANICAL JOINTS – The general requirements already set forth shall apply except that, where the terms "bell" and "spigot" are used, they shall be considered to refer to the bell and spigot ends of the lengths of mechanical joint pipe. The last eight inches (20.3 cm) outside of the spigot and inside of the bell of the mechanical joint pipe shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter from the joint. The cast iron gland shall then be slipped in the spigot end of the pipe with the lip extension of the gland toward the socket, or bell end. The rubber gasket shall be placed on the spigot end with the thick edge toward the gland. Broken glands shall be replaced by the Contractor at his expense.

The entire section of the pipe shall be pushed forward to seat the spigot end in the bell. The gasket shall then be pressed into place within the bell; care shall be taken to locate the gasket evenly around the entire joint. The cast iron gland shall be moved along the pipe into position for bolting, all of the bolts inserted and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a suitable wrench. Nuts spaced 180 degrees apart shall be tightened alternately in order to produce an equal pressure on all parts of the gland.

B. PUSH-ON JOINTS – The general requirements already set forth shall apply except that, where terms "bell" and "spigot" are there used, they shall be considered to refer to the bell and spigot of the lengths of push-on joint pipe.

There is only one nominal dimension of the spigot outside diameter and the bell inside diameter for each size of push-on joint pipe. Similar dimensions of the caulked-joint bell-and-spigot pipe may vary with the class of pipe for each size in existing lines. Therefore, care should be taken that the outside diameter of the existing line is the same as the outside diameter of the push-on joint pipe being installed, otherwise a special adapter to join the two lines may be necessary.

The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the bell. Since different types of pipe take different types of rubber gaskets, it shall be the responsibility of the Contractor to see that the proper types of gaskets are installed.

Sufficient lubricant shall be furnished with each order to provide a thin coat on each spigot end. The lubricant shall be non-toxic, shall impart no taste or odor to the conveyed liquid, and shall have no deleterious effect on the rubber gasket or pipe. The lubricant shall be of such consistency that it can be easily applied to the pipe in hot or cold weather and shall adhere to either wet or dry pipe.

The spigot end of the pipe shall be entered into the bell with care used to keep the joint from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the bell with a forked tool or jack-type tool or other device approved by the Engineer. Pipe that is not furnished with a depth mark shall be marked before assembly so that the spigot end is inserted to the full depth of the joint. Field-cut pipe lengths shall be filed or ground to resemble the spigot end of such pipe as manufactured. Complete assembly instructions are available from the pipe manufacturer. If pipe is pushed home with a backhoe bucket, a wooden shield must be placed between the backhoe bucket and the end of the pipe.

C. RESTRAINED JOINTS – Where specified or indicated upon drawings, install restrained joints of the following type:

(1) Pipe 24 inches and smaller. For ductile iron pipe use retainer glands equal to Clow Mechanical Retainer Glands, Megalug Series 1100, or U.S. Pipe TR Flex.
(2) Pipe 30 inches or larger used restrained joints equal to American Pipe Lok Ring joint.

Restrained joint piping shall be ductile cast iron. Design joints for working pressure of 250 psi. Insure that samples of restrained push-on joints have successfully been tested to 500 psi by manufacturer without leakage or joint separation in accordance with AWWA C-101.

3.34 CONNECTIONS WITH EXISTING PIPE LINES – It shall be the Contractor's responsibility to verify the existence and location of all water mains along the route of project. The omission from or the inclusion of locations on the drawings is not to be considered as the non-existence of or a definite location of existing utilities. The Contractor shall take the necessary precautions to protect the existing water main from damage due to his operation, and any damage to or abuse of the water mains encountered shall be repaired by the Contractor at his expense.

Relocation of water main in conflict with construction operations will be the responsibility of the Contractor in accordance with the details as shown on the drawings. The Contractor shall coordinate all such conflicts with the Owner and the Engineer to insure restoration of the line as soon as possible. The Contractor shall furnish, install and remove all necessary valves, fittings, caps, etc. to keep the new and existing water main in service. The Contractor shall notify the Owner 24 hours prior to disturbance of any service. Water mains not in direct conflict with the sewer pipe cross-section shall be protected by the Contractor until his construction operations are a sufficient distance from such conflict to insure no damage thereto. Water mains not in direct conflict with

construction and damaged by the Contractor shall be repaired and restored at the Contractors expense.

Where connections are made between new work and existing piping, such connections shall be made in a thorough and workmanlike manner, using suitable and proper fittings to suit the conditions encountered. Each connection with an existing water pipe shall be made at a time and under conditions which will least interfere with water service to customers affected thereby and as authorized by the Owner. Suitable facilities shall be provided for proper dewatering, drainage, and disposal of all water removed from the dewatered lines and excavations, without damage to adjacent properties.

A. CONNECTION – A connection to an existing water main that is not under pressure will be made with a fitting and compression sleeve couplings. The Contractor shall be responsible for controlling and disposing of the water in the trench, removal of plugs, fittings, thrust blocks, anchors, cutting of existing mains, installation couplings and/or sleeves, etc.

B. PRESSURE CONNECTION – A pressure connection shall include all necessary tapping tees, gate valves, and fittings needed to connect to the existing water mains. Pressure connections are to an existing water main that is under pressure. The Contractor shall be responsible for controlling and disposing of the water in the trench. A thrust block will be required.

3.35 RELATION OF WATER MAINS TO SEWERS – Sewers shall be separated from water mains according to the Nebraska Health and Human Services accepted "Recommended Standards for Water Works", by the Committee of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Manager, Latest Edition.

A. PARRALLEL INSTALLATION – Water mains shall be laid at least 10 feet (3.05m) horizontally from any existing or proposed sewer. The distance shall be measured edge to edge.

B. CROSSINGS – Water mains crossing sewers shall be laid to provide a minimum vertical distance of 18 inches (45.7 cm) between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer. At crossings, a full length of water pipe shall be located so both joints will be as far from the sewer as possible.

3.40 WATER MAIN APPURTENANCES

3.41 SETTING OF VALVE AND FITTINGS – Valves and fittings installed in trenches shall be located where indicated by the drawings and as directed by the Engineer. Valves, fittings, plugs, and caps shall be set and joined to pipe in the manner specified for cleaning, laying and joining pipe. Fittings will be blocked using only cast-in-place concrete blocks unless otherwise approved by the Engineer. No wood blocking shall be allowed. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the operating nut of the valve, with the box cover flush with the surface of the finished pavement or such other level as may be directed by the Engineer.

3.42 SETTING OF FIRE HYDRANTS – Fire hydrants shall be in accordance with the City of Kearney's Standard Fire Hydrant Setting Detail. Hydrants are to be set at such an

elevation that the connecting pipe and distributing mains will have the same depth of cover. All hydrants shall stand plumb and shall have their steamer nozzle facing the curb or street. Around the base of the hydrant 10 cubic feet (0.28 Cu. M.) of crushed rock or gravel shall be placed so that the hydrant will completely drain when closed.

Backfill around the hydrant shall be firmly tamped to the surface of the finished grade and to a distance of 5 feet (1.52 m) around the hydrant. Before placing any hydrant, care shall be taken to see that all foreign material is removed from within the body or barrel. The stuffing boxes shall be tightened and the hydrant or valve opened and closed to see that all parts are in working condition. Hydrants shall be painted two coats of approved paint, and colors as selected by the Owner, to the ground line and black below the ground line.

3.43 INSTALLATION OF BRACING, SUPPORTING AND ANCHORING – Blocking, bracing, anchoring, or other acceptable means for the prevention of movement, shall be installed. All blocking, bracing, supporting and anchoring shall be in accordance with the City of Kearney's Standard Blocking Detail and the City of Kearney's Standard Fire Hydrant Detail with the use of concrete as specified in section #12 Portland Cement Concrete Paving of this standard specification.

A. ANCHORAGE FOR FIRE HYDRANTS – The bowl of each hydrant shall be well braced against the undisturbed natural earth at the end of the trench with a concrete anchor placed behind and a precast block beneath the bowl. The fire hydrant valve shall be tied to the fire hydrant tee with anchor pipe or with two (2) ¾ inch (1.91 cm) or larger all-thread rods as shown on the City of Kearney's Standard Fire Hydrant Detail, Mega Lugs / retaining glands will be allowed.

Whenever a fire hydrant is the means of terminating a water main (such as in a cul-de-sac); the tie rods and concrete reverse anchors will be required for both the fire hydrant valve (which in this case is also a line valve on the main) and the fire hydrant lateral of the branch feeder pipe connected directly to the fire hydrant. Additional concrete anchors shall be as directed by the Engineer.

B. ANCHORAGE FOR PLUGS, CAPS, TEES, TAPS AND BENDS – Plugs, caps, tees and bends shall be provided with reaction backing in accordance with the City of Kearney's Standard Blocking Detail. Reverse concrete anchor and tie backs are acceptable. Blocking shall be placed between solid ground and the fitting to be anchored; the area of bearing on the pipe and on the ground, in each instance, shall be shown or directed by the Engineer. No wood or precast blocks shall used as a permanent blocking. Temporary blocking may be used as directed by the Engineer. Blocking will be required regardless of whether a tapping tee or tapping saddle is used. Such blocking will in all cases be sized and placed in a manner that will adequately transfer thrust reaction to solid undisturbed ground or the equivalent thereof.

C. FORMING FOR CONCRETE THRUST BLOCKS AND ANCHORS – All forming for concrete thrust blocks and anchors will be done by bulk heading around the shape of thrust block or anchor with burlap or reinforced paper sacks which have been filled with sand or earth, or other Engineer approved forming method. Filled sacks used to form concrete blocks will be left in place in the trench and backfill will be placed around and over them in the usual manner. Any bolt head or fitting must be left accessible when

pouring concrete about them. If the fitting is to be covered completely upon direction of the Engineer, then the joint must be wrapped with suitable polyethylene.

Minimum curing time for concrete anchors regardless of additives shall be thirty-six (36) hours for anchors containing 2 cubic yards (1.53 cu. M) or less, fort-eight (48) hours for anchors containing more than 2 cubic yards (1.53 cu. M) but less than 6 cubic yards (4.59 cu. M) and seventy-two (72) hours for anchors containing more than 6 cubic yards (4.59 cu. M) but less than 12 cubic yards (9.17 cu. M). Anchors containing more than 12 cubic yards (9.17 cu. M) will be cured as directed by the Engineer. Curing time for anchors having flanged rods or other accessories embedded in them for the purpose of tying pipe and/or fittings directly to the anchor will require approximately 25% additional curing time.

3.50 SERVICE CONNECTIONS

A. WATER SERVICES – Water services shall include the lines to, and connections with, the building service at a point approximately at the edge of the right-of-way where such building service exists. Where existing service to a building does not exist, the Contractor shall terminate the service at approximately the right-of-way at a point designated by the Engineer. All new water services which are not immediately connected shall be plugged with a watertight stopper furnished by the pipe manufacturer. A strand of #9 wire shall be attached to the plugged end of the curb stop and ran to the surface and attached to the water service location sign as shown in the City of Kearney's Standard Construction Details. All service stops and gate valves shall be provided with extension service boxes of the lengths required by the depths of service line stops or valves.

Installation shall be in accordance with the City of Kearney's Standard Service Connection Detail. Material for and construction of water service relocation shall be in accordance with the previously specified appurtenances and all material shall be new and furnished by the Contractor. Water services shall remain in service and shall be protected by the Contractor. All new services unless otherwise shown or specified shall be 1 inch in diameter. Service lines shall be laid perpendicular to the line of the main. No service shall be installed between the fire hydrant and the fire hydrant control valve.

The connection to the main for 2 inch (5.08 cm) service lines and smaller in diameter shall consist of a corporation stop and a service stop below the frost line. Where more than one gooseneck connection to the main is required for an individual service, such connection shall be made with standard quality branch connections in conformance with recognized standard practice. The total clear area of the branches shall be at least equal to the clear area of the service which they are to apply. All 2 inch services shall have a valve box not a curb stop. No services shall be made to any water main larger than 16 inches in diameter, unless approved by the City.

All new services, relocation and/or restoration of existing water services encountered along the route of the Contractor's work shall be the responsibility of the Contractor at his expense. Existing services are not to be connected to new water mains until disinfection test have been approved by the Engineer. The Contractor shall keep an accurate record of the location of all plugged services. On completion of the job the contractor shall provide a copy of the list to the Engineer.

B. SANITARY SEWER SERVICES – The Contractor shall restore and/or relocate all existing sanitary sewer services encountered during his pipe laying operations which are in direct conflict with his operations. Materials for and construction of said services shall be in accordance with General Specifications and be accomplished in a workmanlike manner. The size and material of service to be restored shall be compatible with the service so encountered, and no reduction in size shall be allowed unless so directed by Engineer. Where marginal clearances are encountered to restore the service to the existing lateral or main, encasement or cradling shall be performed as directed by the Engineer. The Contractor shall furnish all material to complete this item and all materials shall be new. Sanitary sewer services above or below the line of the pipe cross-section shall remain in service and shall be protected by the Contractor, and shall not be considered as a pay item. Damage to any such services not in conflict with construction shall be restored by the Contractor at his expense.

3.70 QUALITY ASSURANCE

A. DISINFECTION – After favorable performance of the pressure test, thoroughly flush the entire potable water piping system with a velocity of not less the 3.0 feet per second. Before starting to flush new water mains, the City of Kearney's Utilities Department requires 24 hours of notice. Drain flushed water to location approved by the Owner. Each unit of the completed system shall be disinfected with chlorine before acceptance for domestic operation. All disinfection performed shall be accomplished under the supervision of the Engineer.

B. METHOD – Disinfection shall be accomplished as described below by the AWWA Standard Specification C-651. The amount of chlorine applied shall be such as to provide a dosage of not less than fifty (50) mg/L. The chlorinating material shall be introduced to the waterlines and distribution system in an approved manner. If possible to do so, the lines shall be thoroughly flushed prior to the introduction of the chlorinating materials. After a contact period of not less than 24 hours, the heavily chlorinated water shall be flushed from the system with clean water until the residual chlorine content is not greater than two-tenths (0.2) mg/L. All valves in the lines being disinfected shall be opened and closed several times during the contact period. All chlorinated compounds shall conform to AWWA Standard Specifications B-300, B-301, and B-302. If the method of installing chlorine is tabs glued to the inside of the pipe, the glue shall be biodegradable, non-toxic and shall meet all requirements of NSF for drinking water. The amount of glue used shall not exceed the size of tablet and and in no case shall the drop exceed ¼" in diameter.

C. TESTING – After final flushing and before water main is placed into service, two sets of consecutive water samples, free of chlorine, taken at least 24 hours apart, shall be submitted to an approved State Department of Health and Human Services Laboratory for the detection of coliform and non-coliform bacteria. The results shall be submitted to the Engineer. If the laboratory analysis shows the water is unsafe to use,(presence of any coliform bacteria) disinfection and analysis shall be repeated until two consecutive zero coliform and non-coliform counts are obtained.

The Contractor shall collect and test for chlorine concentration prior to flushing and upon termination of flushing. The number of samples required shall be as indicated in AWWA C-651 which follows:

"Standard Condition After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least 24 hours apart, shall be collected from the new main. At least one set of samples shall be collected from every 1200 ft (366 m) of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality in accordance with Standard Methods for the examination of Water and Wastewater, and shall show the absence of coliform organisms. A standard heterotrophic plate count may be required at the option of the owner (or owner's representative).

Special Conditions If trench water has entered the new main during construction or, if in the opinion of the owner (or owner's representative), quantities of dirt or debris have entered the new main, bacteriological samples shall be taken at intervals of approximately 200 ft (61 m) and shall be identified by location. Samples shall be taken of water that stood in the new main for at least 16 hours after final flushing has been completed."

D. PRESSURE AND LEAKAGE TESTS – The pipeline shall be subjected to pressure and leakage tests as specified herein and completed in accordance with the latest edition of AWWA Standards. The required pressure and leakage tests shall be made after all pipe laying and backfilling work has been completed. All concrete reaction blocks and bracing or restraining facilities shall be in place at least 7 days before the initial filling of the line, except where tension joints are used at bends.

The pressure and leakage tests shall be applied to the entire line, service connections and appurtenances. The Contractor shall be solely responsible for any and all damages to the pipelines, and to public and private property, which results from defective materials or workmanship. The section of the line to be tested shall slowly be filled with water and all air expelled from the pipe. Care shall be taken that all air valves are installed and open in the section being filled, and that the rate of filling does not exceed the venting capacity of the air valves.

E. TEST EQUIPMENT AND FACILITIES – The Contractor shall perform the necessary work to fill the pipeline with test water, as specified. The Contractor shall furnish all pumping equipment, water meter, pressure gauge, and all equipment, materials, and facilities required for the tests. Test pressures shall be applied by means of a force pump of such design and capacity that the required pressure can be applied and maintained without interruption for the duration of each test. The water meter and pressure gauge shall be accurately calibrated and shall be subject to the approval of the Engineer.

F. PRESSURE TEST – The low point in the pipeline for each test section shall be subjected to a test pressure of 150 psi (10.56 kg/sq. cm). Test pressure shall not exceed the rated pressure of the valves, pipe or appurtenances when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves. After the section of the line to be tested has been filled with water, the specified test pressure shall be applied and maintained for a period of not less than 2 hours and for whatever longer period as may be necessary for the Engineer to complete the inspection of the line under test or for the Contractor to locate any and all defective joints and pipeline materials. If repairs are needed, such repairs shall be made, the line

refilled, and the test pressure applied as before; this operation shall be repeated until the line and all parts thereof withstand the test pressure in a satisfactory manner.

G. LEAKAGE TEST – After the specified pressure test has been completed, the line being tested shall be subjected to a leakage test under a hydrostatic pressure of 150 psi (10.56 kg/ sq. cm). The pressure shall be maintained constant (within a maximum variation, plus or minus, of 5 psi) during the entire time that line leakage measurements are being made, so that the allowable leakage rate may be determined accurately from the leakage rate formula.

Leakage tests shall not be started until a constant test pressure has been established. Compression of air trapped in un-vented pipes or fittings will give false leakage readings under changing pressure conditions. After the test pressure has been established and stabilized, the line leakage shall be measured by means of a water meter installed on the line side of the force pump. Line leakage is defined as the total amount of water introduced into the line as measured by the meter during the leakage test. The pipeline, or tested section thereof, will not be accepted if and while it has a leakage rate in excess of that rate determined by the following formula for the specific type of pipe:

Ductile Iron Pipe

$$Q=\frac{LD(P)^{1/2}}{148{,}000}$$

Q = Maximum permissible leakage rate, in gallons per hours
L = Length of pipe tested, in feet
D = Nominal internal diameter of the pipe, in inches
P = Average test pressure, in pounds per square in (gauge)

Where the leakage test shows a leakage rate in excess of the permissible maximum, the Contractor shall make all necessary surveys in connection with the location and repair of leaking joints to the extent required to reduce the total leakage to an acceptable amount. All joints in piping and closed valves shall be watertight and free from visible leaks during the prescribed tests. Each and every leak which may be discovered at any time prior to the expiration date of one year from and after the date of final acceptance of the work by the Owner shall be located and repaired by and at the expense of the Contractor, regardless of any amount that the total line leakage rate during the specified leakage test may be below the specified maximum rate.

H. FINAL ACCEPTANCE – The newly constructed waterline shall be keep isolated from the existing water system until final approval from the Nebraska Department of Health and Human Services is received by the City. After the Health Department approval, the contractor shall make arrangements with the City to return to the project and open all the valves and flush the new constructed lines before it is placed into service.

3.80 SUBMITTALS

A. Certification by Manufacturer - The Contractor shall furnish a statement from the manufacturer that the inspection and all the specified tests have been made and the results thereof comply with the requirements of the applicable standards herein specified for all materials furnished.

B. Quality Control Testing – The Contractor shall submit but not be limited to the following:

1. Chlorine Concentration Testing
2. Bacteriological Quality Testing
3. Pressure and Leak Testing

C. Shop Drawings – The Contractor shall submit sufficient data and information to allow an evaluation of "or equal materials". If required, samples with detailed technical data shall be furnished. Shop drawings for, but not limited to, water main, fire hydrants, valves and boxes, meters, meter pits, service lines, curb stops, curb boxes, corporation stops, couplings, shall be submitted.

3.90 MEASUREMENT AND PAYMENT

A. Measurement and payment - The following methods of measurement and payment to the Contractor will be used on all projects Owned and let by the City of Kearney unless otherwise specified in the Detailed Specifications. Items not specifically listed in the Bid or defined by this specification shall be considered subsidiary to construction and direct payment will not be made for these items.

B. Water Mains – The length of water mains to be paid for will be measured along the centerline of the various sizes of pipe furnished and installed, from center of fitting to center of fitting. No deduction will be made for the space occupied by valves or fittings. Payment for water mains will be made at the unit price bid per linear foot of the various sizes, complete in place. Polyethylene Encasement shall be included in the until BID price for watermain.

C. Pipeline Specials – Where specific units of construction are included in the BID form for gate valves and boxes, fittings, fire hydrants, valve manholes and other pipeline specials, payment will be made at the unit price bid, based on the number of such pipeline specials, complete in place.

D. Fire Hydrants – Payment for hydrants shall be at the bid unit price and shall include the tie rod assembly between the gate valve and fitting on the main, backing blocks and crushed rock. If gate valves and boxes are installed at the hydrant locations, they shall be paid for separately as set forth in the BID. The pipe run from the main to the hydrant will be measured and paid for under the respective bid item for watermain in place.

E. Connections – Direct payment for connections include all labor and materials, including coupling to hook-up the existing water mains to the new watermain. Fittings and pipe shall be paid for as set forth in the Bid Schedule. Items not specifically indicated in the BID will be considered subsidiary to the items for which direct payment is made.

F. Pressure Connections – Direct payment for pressure connections shall be paid for at the bid unit price for tapping tee and valve. Items included shall include but not be limited to the tapping tee, valve, valve box, thrust block and all other materials, equipment and labor. Items not specifically indicated in the BID will be considered subsidiary to the items for which direct payment is being made.

G. Water and Sewer Crossings – Payment for water and sewer crossings will be made at the contract unit price as set forth in the BID and will include all material and labor required for installation, complete in place.

H. Service Lines – Payment for the length of the service lines shall be measured horizontally along the centerline of the various sizes of pipe furnished and installed, from the near edge of the water main to the termination of the service line. Payment for the service lines will be made at the unit price bid per lineal foot of the various sizes, complete in place.

I. Service Reconnections for Water and Sewer – No direct payment for existing service reconnections or relocations will be made. All incidental work shall be considered subsidiary to the service reconnections or relocations will be made. All incidental work shall be considered subsidiary to the total BID.