SECTION 5000--WATER LINES

5001 SCOPE. This section covers all labor and materials for the construction of water lines including all thrust blocks, plugs, valves, pipe encasement, valve boxes, hydrants, connections to existing mains and other appurtenant work.

The City is not responsible for locating constructed waterline improvements until the Project Completion Certificate (PCC) has been approved. The Contractor is responsible for locating and protecting the waterline and appurtenances from damage until the project is accepted by the City Engineer.

All products to be used in contact with potable water shall be NSF 61 certified.

All exposed bolts and nuts within the water system shall be 316 or 304 stainless steel.

All products shall be NSF 372 certified to comply with the Reduction of Lead in Drinking Water Act, effective 2014.

5002 PIPE FITTINGS. The manufacturer of any material or equipment shall provide certification, in duplicate, to the City Engineer, indicating that their product meets these Standard Specifications and applicable AWWA standards. The certification shall be shipped with the product and be available to the City Engineer prior to installation.

All ductile iron fittings shall be encased in (1) layer of 8-mil polyethylene film or tape and shall conform to AWWA C105 with all ends sealed and visually inspected.

Polyethylene tubular or sheet encasement shall be free of tears, breaks, and defects. The film shall be linear low-density and shall be manufactured from virgin polyethylene material conforming to AWWA C105.

Polyethylene tape shall be 1-1/2-inch wide, plastic-backed adhesive tape. Duct tape or other tape not specified on the Approved Materials List shall not be used, unless otherwise approved by the City Engineer. Installation shall be as described in AWWA C105.

Any cuts, tears, punctures, or damage to the polyethylene encasement shall be repaired using adhesive tape or a short length of polyethylene sheet wrapped around the pipe to cover damaged area and secured in place.

Backfill material shall be free from cinders, refuse, boulders, rocks, stones or other material that could damage the film, and placed in accordance with the Standard Details.

5003 PVC PIPE. For water line diameters four (4”) inches through twelve (12”) inches, PVC shall meet the requirements of ASTM D1784, cell classification 12454-B for PVC compounds, and ANSI/AWWA C900, with the same outside diameter dimensions as ductile iron pipes. The pipe shall be Class 150 unless other designated by the City Engineer.

The location of all water mains shall be marked on the ground surface during construction. All marks shall remain until the project completion certification has been issued.

5004 HDPE PIPE. HDPE Pipe may be used for distribution mains that are less than twelve (12”)

inches in diameter. Water service pipe shall meet the requirements of ASTM D2239, AWWA C901, and NSF/ANSI Standards 14 ad 61. All pipe dimensions shall adhere to the Iron Pipe Size (IPS) standards.

5005 **TRACER WIRE.** Underground tracer wire shall be installed to enable detection of all HDPE water mains and shall be installed in accordance with the Design Criteria.

Tracer wire used in open cut applications shall be 12 AWG copper clad steel with a 30 mil HDPE jacket and a minimum break load of 450 lbs. Tracer wire used in horizontal directional drilling applications shall be 12 AWG copper clad steel with a 45-mil blue HDPE jacket and a minimum break load of 1,150 lbs. Tracer wire for pipe bursting applications shall be 3/16" stainless steel with a 45 mil HDPE jacket and a minimum break load of 3,700 lbs.

The tracer wire system must be installed as a continuous single wire. Looping of the tracer wire is not allowed. All mainline tracer wires must be interconnected where tees and crosses are installed. Approved connectors shall be used at these locations and where any other splicing is allowed. Splicing is not allowed on the main line for directional drilling and pipe bursting applications.

The tracer wire shall be attached to the side of the watermain at approximately the 3 o'clock position with tape or tie-wraps.

The tracer wire shall be accessible at test stations and water meter pits for service connections. Enough tracer wire is required in each test station or meter pit to extend the wire a minimum of two feet above finished grade. Test stations will be required along the watermain at a maximum spacing of 800 feet, at intersections (tees and crosses), at dead- ends and at fire hydrants where the distance between the gate valve adjacent to the tee and the fire hydrant exceeds five feet. A single tracer wire will extend from the intersection to the test station at the fire hydrant.

All mainline dead-ends shall be grounded with an approved drive-in magnesium anode rod buried at the same depth as the tracer wire. Extended fire hydrant lines, including fire hydrants at cul-de-sacs, are also considered dead-ends. Test stations will be installed at locations where grounding is required.

The Contractor will perform a post-construction locate to verify the tracer wire is working as intended. This will be done prior to the issuance of the Project Completion Certificate.

5006 **GATE VALVES.** The type, size, and location of valves shall be as indicated on the approved plans. For working pressures from zero to 200 psi, valves shall be resilient seated, non-rising stem and conform to the requirements of AWWA C509.

The gate valves shall be fully encapsulated with resilient wedge disc, unobstructed waterway, counter-clockwise opening and designed for a working pressure of 200 psi. Valves shall be ductile iron conforming to ASTM A395 or A536. Bronze for internal working parts, including stems, shall not contain more than 2% aluminum nor more than 7% zinc, in accordance with ASTM B763 Alloy C99500, except that stem bronze shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 30,000 psi, and a minimum of 12% elongation in 2-inches. O-ring seals and Type 304 or 316 stainless steel body bolts conforming to ASTM F 593 shall be provided by the Contractor. A 2-inch AWWA operating nut for buried installations and a hand wheel for aboveground or in vault installations shall be provided.

Interior and exterior surfaces of gate valves shall have a factory applied, minim average dry film thickness of 8 mil, fusion-bonded epoxy coating in conformance with AWWA C504.

Valve ends shall be push-on type conforming to AWWA C111 except where flanged ends are required in exposed or above-ground applications. The end flanges of flanged gate valves shall be compatible with the connecting piping as required by AWWA C110.

All valves shall be provided with manual operators equipped with a wrench nut conforming to the requirements of AWWA C509.

The direction of rotation of the wrench nut to open the valve shall be to the left (counterclockwise). Each valve body or operator shall have cast thereon the word "*Open*" and an arrow indicating the direction to open.

All exposed bolts and nuts below grade that connect the pipe to the valve, shall be 316 stainless steel, with a hexagonal head, ANSI B18.2.2, heavy semi-finished pattern.

5007 **TAPPING SLEEVES AND VALVES.** Tapping sleeves shall be of Type 304 stainless steel construction with two half sleeves and flanged outlet. Sleeve halves shall be bolted together with 304 stainless steel bolts and nuts. Tapping valves shall have 304 stainless steel nuts and bolts. Gaskets shall completely surround the pipe to be tapped and be the same length as the sleeves. Gaskets shall be Styrene Butadiene Rubber (SBR) conforming to ASTM D2000. Flanged outlet shall be flat faced conforming to ANSI B16.5, Class 250. Tapping machines and cutting tools which have been specifically designed for the type of pipe to be tapped shall be used for all pipe connections.

Water service connection and inspection details are located in the Technical Specifications.

5008 **VALVE COATINGS.** All ferrous metal surfaces of valves and accessories, both interior and exterior, shall be shop-painted with fusion-bonded epoxy coating that meets or exceeds all applicable requirements of AWWA C550 Standard and is certified by ANSI/NSF 61.

Lining and coating shall be 100% solids, thermosetting, fusion-bonded, dry powder epoxy resin in accordance with the Approved Materials List. Epoxy lining and coating shall meet or exceed the requirements outlined in Table 5008-1.

Table 5008-1 *- Epoxy Lining and Coating Requirements*

Item	Requirement
Hardness (minimum)	Barcol 17 (ASTM D2583) Rockwell 50 ("M" Scale)
Abrasion Resistance (minimum)	1,000 cycles: 0.05 gram removed 5,000 cycles: 0.115 gram removed ASTM D1044, Tabor CS 17 wheel, 1,000 gram weight
Adhesion (minimum)	3,000 psi (Elcometer)
Tensile Strength	7,300 psi (ASTM D2370)
Penetration	0 mil (ASTM G17)

Adhesion Overlap Shear, 1/8-inch steel plate, 0.010 glue line	4,300 psi (ASTM D1002)
Impact (minimum)	100 inch-pounds (Gardner 5/8-inch diameter tap)

5009 **VALVE BOX AND EXTENSION STEM ASSEMBLY.** All buried valves shall be installed in 2-piece adjustable screw type valve boxes. Valve boxes shall be suitable for the depth of cover required by the drawings. Valve boxes shall be made of gray cast iron, ASTM A 48, Class 35, conform to the Standard Details, minimum of five (5) inches in diameter and shall have a minimum thickness of 3/16-inch at any point. Covers shall have cast thereon the word "*Water*."

Valve box and extension stem assemblies shall conform to the Approved Materials List.

Valves and valve boxes shall be set plumb. Each valve box shall be placed directly over the valve it serves, with the top of the box brought flush with the finished grade. After being placed in the proper position, gravel backfill shall be filled in around each valve box and thoroughly tamped on each side of the box up to within twelve (12) inches of finished grade.

In undeveloped areas, each valve box shall be marked with a fiberglass marking stake, furnished, and installed by the Contractor, identifying it as a City of Gardner water valve.

5010 **FIRE HYDRANTS.** Fire hydrants shall be ductile iron cast and shall be furnished with a six (6) inch auxiliary gate valve. The fire hydrants shall be pressure rated for a minimum of 150 psi working pressure and 300 psi test pressure. Hydrants shall be traffic models with breakaway flange or coupling. Fire hydrants shall conform to AWWA C502. Table 5010-1 summarizes the fire hydrant requirements:

Table 5010-1 *- Fire Hydrant Requirements*

Ite	Requireme
Type of Shutoff	Compression
Size of Hydrant	5.25 inches
Inlet Connection	6 inches
Outlet Nozzles	2-2.5 inch hose and 1-4.5 inch pumper
Outlet Nozzle Threads	ANSI B26
Direction to Open	Counterclockwise
Stem Seals	O-ring
Drain Outlet	Required

Paint System	Hydrant elbow, nozzle section, bonnet, weather shield, break flanges and nozzle caps shall be powder coated for corrosion protection. Coating shall be free of VOCs and shall be applied by the Manufacturer. See approved materials list for color specifications.
Weather Cap on Operating Nut	Required

Hydrants shall be restrained joint and furnished with all joint gaskets required for installation. Hydrants shall be set so that at least the minimum pipe cover is provided for the branch supply line. Each hydrant shall be set on a concrete foundation at least twelve (12) inches square, six (6) inches thick, and shall be suitably anchored. Hydrants shall be installed using a maximum of one (1) vertical pipe extension. Extensions greater than eight (8) feet below finished grade shall require upsizing the extension one (1) nominal pipe diameter.

Hydrant drainage shall be provided by installing at least ½-cubic yard of ¾-inch rock around the hydrant and below the top of the hydrant supply pipe.

Fire hydrant installations shall conform to Standard Details. All hydrants shall stand plumb. The pumper-nozzle shall be aligned perpendicular to the major thoroughfare.

The hydrant barrel and shoe shall be secured using 316 stainless steel nuts and bolts. All exposed nuts and bolts below the ground level shall be 316 stainless steel and wrapped with polyethylene material, hexagonal, ASME B18.2.1, heavy semi-finished pattern.

Immediately before installation of a hydrant, the following operations shall be performed:

- The hydrant shall be thoroughly inspected.
- The hydrant interior shall be thoroughly cleaned.
- The hydrant shall be opened and closed as many times as may be necessary to determine if all parts are in proper working order, with valves seating properly and the drain valve operating freely.
- The packing gland shall be checked to determine if the packing is in place and the gland nut properly tightened.

5011 FLUSHING ASSEMBLIES. Flushing assemblies shall be provided at the locations shown on the drawings. Each installation shall be complete with all piping, the gate valve, valve box, covers and lids as required, and shall conform with the Standard Details.

5012 MECHANICAL JOINT RESTRAINTS. These shall be such that they can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI/AWWA A21.11 and ANSI/AWWA C153/A21.53. Glands shall be manufactured of ductile iron conforming to ASTM A 536-80 and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. The device shall have a working pressure of at least 250 psi. Approved is the EBAA Iron, Inc., Megalug 1100 PV series for C900 pipe.

5013 FLANGED JOINTS. Flanges shall conform to ANSI B16.1, 125 pound or U.S. Pipe "Flange-Tyte." Bolts shall be ASTM A307, chamfered or rounded ends projecting 1/4- to 1/2-inch

beyond the outer face of the nut which shall be ASTM A307, hexagonal, ANSI B18.2, heavy semi-finished pattern. Gaskets shall conform to ASTM D1330, Grade I, red rubber, ring type, 1/8-inch thick or U.S. Pipe "Flange-Tyte", 1/8-inch thick.

The pipe end and flange face shall be machine-finished in a single operation. Flange faces shall be flat and perpendicular to the pipe centerline.

When bolting flanged joints, care shall be taken to ensure that there is no restraint on the opposite end of the pipe or fitting which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bell and spigot joints shall not be packed or assembled until all flanged joints affected thereby have been tightened. Bolts shall be tightened gradually and at a uniform rate, so that gasket compression is uniform.

5014 RESTRAINED JOINTS. Restrained joints shall be push-on type. Where restrained joints are required or specified, the Mega-Lug, Field Lok® gasket, Fast Grip gasket or approved equal shall be used. Field Lok gaskets shall be used in approved Tyton® Joint, Starr, and Union Tite by Tyler Bells. Fast Grip gaskets shall be used in Fastite Bells. Both assemblies shall be capable of deflection of up to 5 degrees after assembly.

Restrained joint pipe shall be used where shown on the drawings and shall be installed in accordance with the recommendations of the pipe manufacturer. Each restrained joint shall be capable of resisting the thrust of the pressures to be applied.

5015 RETAINER GLANDS. Retainer glands shall be manufactured by American "Mechanical Joint Retainer Glands" or Clow "F-1058" and may be used on 12" or smaller pipe for making connection to existing lines provided their installation is in accordance with the recommendations of the pipe manufacturer.

Retainer glands shall not be used on any new or relocated mains where restrained joints are indicated on the drawings.

5016 HANDLING. Pipe, fittings, and accessories shall be handled in a manner that will ensure installation in a sound, undamaged condition. Equipment, tools and methods used in unloading, reloading, hauling, and laying pipe and fittings shall be such that the pipe, pipe coating and fittings are not damaged. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Pipe and fittings in which the cement lining has been broken or loosened shall be replaced at the expense of the Contractor. The City Engineer shall make the final decision regarding the integrity of the cement lining.

All rejected pipes shall be replaced, with new pipe, at the Contractor’s expense.

5017 CLEANING. The interior of all pipe and fittings shall be thoroughly cleaned of foreign matter prior to installation and shall be kept clean until the work has been accepted. Before jointing, all joint contact surfaces shall be wire brushed if necessary, wiped clean, and kept clean until accepted.

5018 INSPECTION. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation. Spigot ends shall be examined with particular care since they are vulnerable to damage from handling. All defective pipe and fittings shall be removed from the site.

5019 ALIGNMENT. Deflections from a straight line or grade shall not exceed the quantities stipulated in Table 1 or Table 2 of AWWA C600.

Either shorter pipe sections or fittings shall be installed where required by the alignment or grade.

5020 DEAD END LINES. Fire Hydrants shall be installed at the end of all water mains which will have a future six (6) inch and larger water main extension, and at all other dead end lines in accordance with the Standard Details.

5021 CONNECTIONS TO EXISTING WATER MAINS. Connections to existing water mains shall not be allowed for new water main extension projects until all testing and disinfection requirements have been met and the connection has been approved by the City Engineer.

Contractor shall furnish and install the fittings necessary for connections between new water mains and existing water mains. The fittings shall be as indicated on the approved plans, unless otherwise authorized by the City Engineer. When the fittings consist of tapping sleeves and valves, the Contractor shall perform the actual tapping operation of the mains. The City Engineer shall provide the inspection of the Contractor's tapping procedure on all projects.

No connections to existing mains shall be started without prior approval of the City Engineer, and each connection with an existing main shall be made at a time and under conditions which will least interfere with service to customers. All existing ductile iron dead end line assemblies shall be removed prior to the continuation/extensions of waterlines.

When water supply is to be shut-off, the Contractor shall adhere to City of Gardner Waterline Shut-Down and Notice procedure, which is available at www.gardnerkansas.gov. Contractor must follow procedure to meet specification requirements. City personnel will not perform or allow shut down unless procedure is followed.

5022 SANITARY SEWER LINE CROSSINGS. Sanitary sewers and water lines shall be constructed a distance of 10 feet apart when they are to be installed parallel to each other. Exceptions to this requirement shall be granted only upon written approval by the Kansas Department of Health and Environment.

Where water lines are to be constructed over and across sanitary sewer lines, at least 2 feet shall be maintained between the bottom of the water pipe and the top of the sewer pipe. At locations where a 2-foot clearance cannot be maintained, the sewer pipe shall be constructed with casing pipe for a distance of at least 10 feet in each direction from the crossing. The casing pipe joints shall be located as far as practical from the pipe crossing.

Where water lines are to be installed under and across sanitary sewer lines, the sanitary sewer lines shall be constructed with casing pipe for a distance of at least 10 feet in each direction from the crossing. The casing pipe joints shall be located as far as practical from the pipe crossing.

5023 RESTORATION OF SURFACE CONSTRUCTION. See the City of Gardner Technical Specifications.