



**SECTION 02513**  
**WATER LINES – INSTALLATION**

**PART 1. GENERAL**

- 1.1 The work to be performed shall consist of the installation of water lines according to the specifications, other related standards sections and the Standard drawings.
- 1.2 Design drawings must be prepared and sealed by a Professional Engineer licensed by the State of Tennessee. Profile Drawings may be required as directed by the OWNER.
- 1.3 The CONTRACTOR shall be responsible for safely storing materials needed for the work until they have been incorporated into the completed project.

**PART 2. PRODUCTS**

- 2.1 The OWNER will inspect all materials at the site for conformance to the specifications. At the OWNER's discretion, the CONTRACTOR may be required to supply certified mill tests, samples, or other suitable forms of verification that the material meets the required specifications.
- 2.2 New Installation
  - A. Ductile iron pipe shall be in conformance with the latest revision of *ANSI/AWWA C151/A21.51 Standard*. The pipe shall be push-on joint with a minimum pressure class of 350 psi, cement-lined according to *ANSI 21.4/AWWA C-104*, and coated inside and outside with an asphaltic coating. Ductile iron pipe and fittings shall conform to the requirements of the Materials Specifications herein.
  - B. High Density Polyethylene (HDPE) pipe shall be HDPE 3408 and have a heat indented print line containing the information required in ASTM D3035. All HDPE pipe shall be in compliance with *NSF 61* and must be made by a pipe manufacturer that must be approved by the Owner before pipe installation. HDPE pipe must be designated for potable water use by having a minimum of three blue stripes extruded along the entire length of the pipe and also being equally spaced around the outside diameter of the pipe. Color print lines are not an acceptable method for color marking of pipe. Pipes larger than 2 inch shall be Ductile Iron Pipe Size (DIPS) in compliance with *AWWA C906* and *ASTM F 714*. Pipes 2 inch and less shall be Iron Pipe Size (IPS) in compliance with *AWWA C901* and *ASTM D3035*. HDPE pipe 2 inch and larger shall be SDR 11 and pipe smaller than 2 inches shall be SDR 9.

- C. Copper pipe (2-inch diameter) shall be Type-K copper, annealed, and meeting *ASTM B88*, latest revision. The pipe shall be furnished in 20-foot straight laying lengths, and in conformance with the Materials Specifications herein.

### 2.3 Maintenance / Connection to Existing Facilities

- A. PVC pipe (2-inch diameter) and fittings shall be NSF-Approved Class 250. The pipe shall be manufactured from Class 12454-B polyvinyl chloride plastic (PVC 1120) as defined by *ASTM D1784*, and in accordance with *ASTM D2241* and the Materials Specifications herein.

## **PART 3. EXECUTION**

### 3.1.1 3.1 GENERAL REQUIREMENTS

- A. All water lines greater than 2 inches in diameter shall be ductile iron or HDPE pipe. Water lines 2 inches in diameter shall be approved by the OWNER and shall be copper or HDPE pipe under roadway pavement or in bores and tunnels.
- B. All ductile iron and HDPE pipe shall be installed with a blue coated 12-gauge copper clad steel tracer wire, which shall be extended above ground 3 to 4 feet in valve boxes as directed by the OWNER. The tracer wire should be laid 6 inches above the pipe and should not come in direct contact with the HDPE pipe. Tracer wire connections shall be as directed by the OWNER.
- C. Water lines shall be installed as shown in the standards unless otherwise shown on the project drawings.
- D. Timing and procedures of pipe installations, valve closings, temporary services, tie-ups, and interruption of services shall be approved by and coordinated with the OWNER. Contractor shall request OWNER approval at a minimum of 72 hours notice prior to any tie-ins to existing water lines. The OWNER may require that the work be performed during non-business hours if necessary to maintain services.
- E. Unless otherwise indicated by the drawings, all water lines shall have at least 36 inches of cover from the top of the pipe. The OWNER shall approve all exceptions.
- F. The maximum trench width for water line installations shall be 24 inches for 6- and 8-inch lines, 30 inches for 10- and 12-inch lines, 36 inches for 16- and 24-inch lines, and 54 inches for 30-inch lines. Trench widths for larger sizes shall be approved by the OWNER. Minimum trench widths must be achieved to ensure

proper backfilling around the pipe and to allow inspection of HDPE pipe sidewalls and trench bottom contour.

- G. The CONTRACTOR shall provide and use tools and facilities that are satisfactory to the OWNER and that will allow the work to be done in a safe and convenient manner. All pipe, fittings, valves, and hydrants are to be unloaded from the trucks using suitable tools and equipment. A derrick, ropes, or other suitable tools or equipment shall be used to lower all pipe, fittings, valves, and hydrants into the trench one piece at a time. Each piece shall be lowered carefully so that neither it nor any protective coating or lining will be damaged. Under no circumstances shall water line materials be dropped or dumped.
- H. Every precaution shall be taken to keep foreign material from getting into the pipe while it is being installed. No debris, tools, clothing, or other materials shall be placed in the pipe during laying operations.
- I. Whenever pipe laying is not in progress, the open ends of the pipe shall be closed either with a watertight plug or by other means approved by the OWNER.
- J. Wherever pipe must be deflected from a straight line, (in either the vertical or horizontal plane) in order to avoid obstructions or plumb stems, or wherever long radius curves are permitted, the amount of deflection shall neither exceed that necessary for the joint to be satisfactorily made, nor exceed that recommended by the pipe manufacturer and shall be approved by the OWNER. Bend fittings shall only be used when the pipe deflections are inadequate, according to manufacturer's recommendations, or as directed by the OWNER.
- K. No pipe shall be installed in water or when it is the OWNER's opinion that trench conditions are unsuitable. If crushed stone is used to improve trench conditions or as backfill for bedding the pipe, its use is considered incidental to the project.
- L. Water lines shall be designed with a 10-foot horizontal separation from any existing or proposed sewer main. If this is not practical, the water main may be placed closer than 10 feet from a sewer main, provided it is laid in a separate trench and that the elevation of the top of the sewer is at least 18 inches below the bottom of the water main, or as directed by the OWNER.
- M. Where a water main crosses over a sewer, the top of the sewer shall be at least 18 inches below the bottom of the water main. If the elevation of the lines cannot be adjusted to meet the 18-inch separation, then the water main shall be constructed with ductile iron pipe for a distance of 10 feet on either side of the sewer, with a full pipe section centered over the sewer, or as directed by the OWNER.

- N. All water distribution mains shall be flushed prior to inspection as specified below to assure complete removal of all debris and foreign material.
- P. On water lines to be abandoned, all water appurtenances shall be removed to a minimum depth of 6 inches below the proposed grade and backfilled in accordance with Section 02321 herein.

### 3.2 Ductile Iron Mains

- A. After a length of ductile iron pipe has been placed in the trench, the spigot end shall be centered in the bell of the adjacent pipe and then inserted to the depth specified by the manufacturer.
- B. Bell holes, when required, shall be big enough so that there is ample room for the pipe joints to be properly made. The trench shall be carefully graded so that the pipe barrel will rest on a solid foundation for its entire length. Pipe shall be laid and continuously supported on undisturbed or well-compacted soil. Pipe shall not be supported by blocks or allowed to rest on rocks or any other material that could cause shearing stresses on the pipe during backfill. All backfilling shall be in accordance with Section 02321 herein.
- C. Pipe shall be cut so that valves, fittings, or closure pieces can be inserted in a neat and workman-like manner and without any damage to the pipe. The manufacturer's recommendations shall be followed to cut and machine the ends of the pipe in order to leave a smooth end at right angles to the pipes axis. For cast iron pipe, hydraulic cutters or a carborundum saw shall be used. A carborundum saw shall be used for ductile iron pipe. The OWNER may consider other methods for 12-inch diameter and larger pipe.
- D. Pipe shall be installed with the bell ends facing in the direction of laying unless otherwise directed by the OWNER.

### 3.3 High Density Polyethylene (HDPE)

- A. Prior to installing pipe through a bored hole, ensure that the size of the hole is of sufficient diameter to prevent pipe stress during installation. The leading end of the pipe to be inserted shall be closed to prevent the entrance of dirt and debris. After insertion, the leading end of the pipe shall be examined in the exit bell hole to ensure that the pipe has not been damaged during insertion. Damaged pipe shall be replaced after corrective measures have been taken to prevent damage to the replacement pipe.
- B. HDPE pipe shall be handled using canvas or nylon slings. If a forklift is to come in direct contact with HDPE pipe, the forks shall be padded. HDPE pipe shall be

stored in a manner, which minimizes crushing or bending. HDPE pipe should lay flat and be stacked no higher than 84 inches. HDPE pipe coils shall not be stored in a vertical position. HDPE pipe shall be transported and stored so that it does not come in contact with debris or materials that could cause damage to the pipe.

- C. Any pipes placed along the route of the proposed lines before the actual installation of the lines shall not be lowered into the trench until they have been swabbed to remove any mud, debris, etc., that may have accumulated within them. Pipe shall be placed along the route a maximum of one day ahead of pipe laying. All unnecessary material shall be removed from the bell and spigot end of each pipe. Before any pipe is laid, the outside of its spigot end and the inside of its bell shall be cleaned and left dry and oil free. HDPE pipe shall be inspected prior to fusion and prior to lowering the pipe into the trench to ensure that the pipe does not contain any debris. The pipe shall be cleaned if necessary to remove debris.
- D. Pipe shall be inspected prior to and after lowering into the trench for any damage. HDPE pipe shall be carefully inspected for cuts, gouges, deep scratches, or other defects. Any segment containing defects shall be removed and replaced. HDPE pipe shall not be used if gouges or cuts are greater than 10 percent of the wall thickness. When lowering HDPE pipe into the trench, the pipe shall not be subjected to excessive twisting and bending stresses. Allow for contraction of small diameter HDPE pipe by “snaking” the pipe from side to side in the trench.
- E. All pipe shall be joined in the exact manner specified by the manufacturers of the pipe and joining materials.
- F. HDPE fusion joints shall be allowed to cool for the required time. The CONTRACTOR shall be qualified to perform HDPE fusion by the product manufacturer and shall provide proof of qualification prior to beginning work.

### 3.4 HDPE PIPE JOINING – PROCEDURES AND QUALIFICATIONS

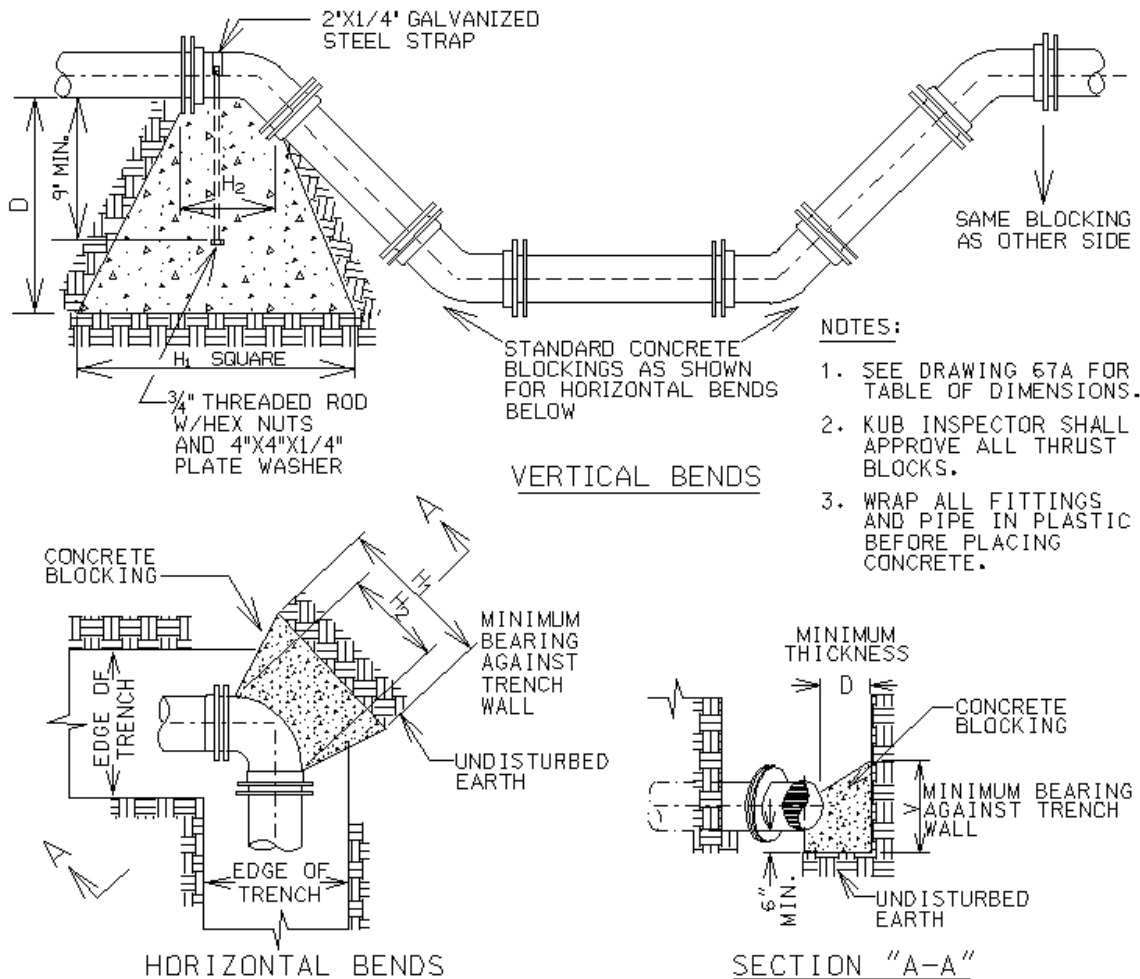
- A. HDPE pipe must be joined using a qualified joining procedure and by persons qualified on that procedure.
- B. HDPE shall be joined using butt fusion, unless otherwise approved by owner. All mains and services shall be butt fused, unless otherwise approved by owner. Fusion shall take place in weather conditions acceptable to the OWNER.
- C. Procedure Qualification - all joining methods for polyethylene pipe be qualified. The polyethylene pipe manufacturers have developed qualified procedures for heat fusion of HDPE pipe. KUB has adopted the Plexco Pipe procedure for all

saddle and butt fusion of polyethylene pipe and fittings. KUB has adopted Central Plastics Procedures for electrofusion. All heat fusion joints will be visually inspected to determine if they have the same appearance as a joint properly made under the qualified procedure.

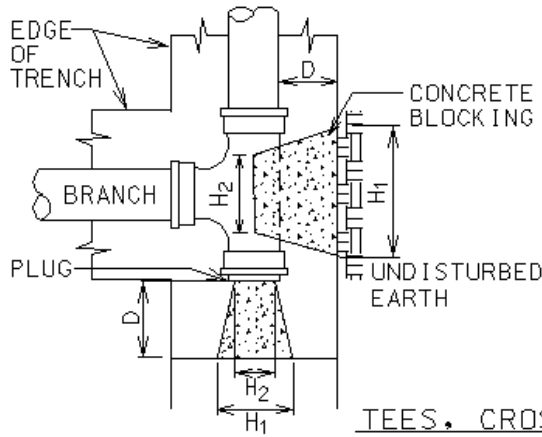
- D. Joiner Qualification - persons making either heat fusion or mechanical joints shall be qualified using applicable joining procedures mentioned above. Each person will be required to qualify for each of the joints they are expected to make. The qualifying procedure for polyethylene pipe joiners will consist of :
  1. Training and experience with the qualified procedure.
  2. Making a specimen joint according to the qualified procedure.
  3. Visual inspection of the specimen joint to determine if it has the same appearance as a joint properly made under the qualified procedure.
  4. For heat fusion joints, three longitudinal straps, 1 inch wide, cut from the joint will be examined for defects and then deformed by back bend, root bend, or torque. If failure indicates outside the joined area, the joint is acceptable.
  5. For service saddle tee fusion, the test specimen will be secured and struck with a 3 lb. hammer.
- E. Qualification of persons making joints for each procedure will remain effective for 1 year from the date of testing, unless the OWNER requires more frequent retraining due to quality of joints completed.
- F. CONTRACTOR fusion training shall be completed by a manufacturer or manufacturer representative acceptable to the OWNER. CONTRACTOR shall provide proof of training acceptable to the OWNER.
- G. All personnel performing plastic pipe fusion shall at all times while performing the fusion have readily available on the job site proof of qualification from the manufacturer or other acceptable training company.
- H. Mechanical couplings designed for use in HDPE piping systems have qualified installation procedures developed by the manufacturers. These procedures shall be followed for installation. All field mechanical joints will be visually inspected to determine if they have the same appearance as a joint properly made under the qualified procedure. All mechanical couplings used in plastic piping systems shall be designed to resist pullout.
- I. Aqua-grip or other OWNER approved fittings shall be used for wet tie-ins.

### 3.5 THRUST BLOCKS / THRUST RESTRAINT

- A. Thrust blocks shall be installed on ductile iron pipe wherever the water main changes direction (at tees and bends), at dead ends, or at any other point recommended by the manufacturer or required by the OWNER. Thrust blocks shall be considered an integral part of the water line work. Where thrust blocking is inadequate or inappropriate, tie rods shall be installed. Non-fusion type HDPE joints shall be restrained using approved mechanical joint adapters listed in the approved materials for HDPE installations. Compaction standards shall be strictly enforced near HDPE fittings. Backfill material near HDPE fittings shall be crushed stone, Class A Aggregate Grading D, as specified in *Section 903.05* of the Tennessee Department of Highways' *Standard Specifications for Road and Bridge Construction, March 1, 1995* (pug mix), placed in 8-inch lifts and compacted to 100 percent of the Standard Proctor density at 2 percent less than the optimum moisture content as determined by *AASHTO T99-81*.



**Figure 1-02513-a (Thrust Block Details)**



**NOTES:**

1. DIMENSIONS FOR TEES, CROSSES, AND PLUGS ARE CONTROLLED BY DIAMETER OF BRANCH MAIN.
2. KUB INSPECTOR MUST APPROVE ALL THRUST BLOCKS.
3. WRAP ALL FITTINGS & PIPE IN PLASTIC BEFORE PLACING CONCRETE.

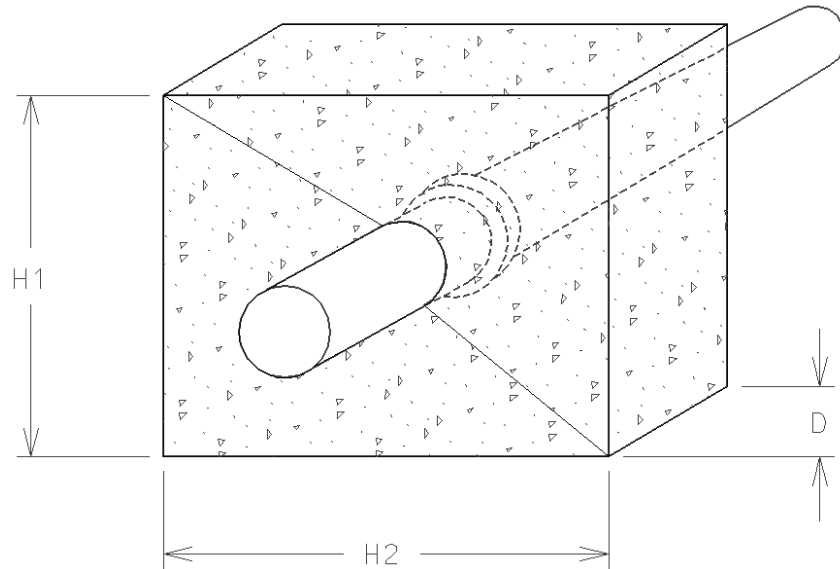
TEES, CROSSES & BENDS

TABLE OF DIMENSIONS FOR CONCRETE BLOCKING																															
SIZE	TEES, PLUGS CROSSES					90° BENDS					45° BENDS					22½° BENDS					11¼° BENDS					SIZE					
PIPE	H <sub>1</sub>	H <sub>2</sub>	V	D	CU FT.	H <sub>1</sub>	H <sub>2</sub>	V	D	CU FT.	H <sub>1</sub>	H <sub>2</sub>	V	D	CU FT.	H <sub>1</sub>	H <sub>2</sub>	V	D	CU FT.	H <sub>1</sub>	H <sub>2</sub>	V	D	CU FT.	PIPE					
2&2 1/4	18	10	12	18	1.9	18	10	12	18	1.9	18	6	12	18	1.5	18	6	12	18	1.5	18	6	12	18	1.5	18	6	12	18	1.5	2&2 1/4
3&4	24	12	12	18	2.3	24	12	12	18	2.3	18	8	12	18	1.6	18	8	12	18	1.6	18	8	12	18	1.6	18	8	12	18	1.6	3&4
6	24	16	18	18	3.5	30	16	18	18	4.1	24	10	16	18	3.2	24	10	16	18	3.2	24	10	16	18	3.2	24	10	16	18	3.2	6
8	36	18	18	18	5.1	39	18	24	18	7.3	30	11	18	18	4.0	24	11	18	18	3.5	24	11	16	18	3.4	24	11	16	18	3.4	8
10	48	24	18	24	7.2	54	32	24	18	10.3	24	18	21	18	4.6	24	18	21	18	4.6	24	18	21	18	4.6	24	18	21	18	4.6	10
12	54	30	24	24	13.4	54	32	36	24	18.2	42	18	24	24	9.6	24	18	24	24	6.6	24	18	21	24	6.1	24	18	21	24	6.1	12
14	60	32	30	24	17.9	60	40	42	24	25.0	44	24	30	24	13.2	30	24	24	24	9.2	27	21	24	24	7.9	24	21	24	24	7.9	14
16	60	34	36	24	22.5	69	48	48	24	29.0	48	30	36	24	17.0	36	30	27	24	11.8	27	24	27	24	9.1	24	27	24	24	9.1	16
18	72	36	40	24	30.0	72	48	60	24	38.0	48	30	42	24	21.0	42	30	30	24	15.0	30	30	36	24	13.0	24	30	36	24	13.0	18
20	84	38	42	24	36.0	84	48	66	24	48.0	54	40	46	24	27.0	48	36	36	24	19.0	42	40	36	24	18.0	24	40	36	24	18.0	20
24	108	42	48	24	45.0	108	60	72	24	68.0	60	48	56	24	41.0	54	42	42	24	25.0	48	42	42	24	23.0	24	42	42	24	23.0	24
30	132	52	60	24	70.0	132	72	92	24	104	72	48	76	24	58.0	60	48	48	24	32.0	54	48	54	24	32.0	24	54	54	24	32.0	30
36	162	58	72	24	100	162	96	108	24	150	84	72	84	24	85.0	66	72	60	24	50.0	60	48	60	24	40.0	24	60	60	24	40.0	36

DIMENSIONS IN TABLE ARE IN INCHES.

**Figure 2-02513-b (Thrust Block Details and Table of Dimensions)**





HDPE Pipe Size	H1	H2	D	Cubic Ft
2"	18"	18"	24"	4.5
4"	18"	24"	24"	6.0
6"	24"	24"	24"	8.0
8"	36"	36"	24"	18.0

**Figure 3-02513-c:** (Concrete Thrust Restraint and Table of Dimensions - HDPE Pipe)

**Notes:**

- I. All pipe and fittings in contact with concrete thrust restraint blocks should be wrapped in plastic sheeting, minimum 6-mil thickness.
  - II. Concrete thrust restraints for HDPE pipe shall be installed when transitioning from HDPE pipe to sections of unrestrained slip joint pipe as shown on the project drawings or as directed by the OWNER.
- B. Megalugs and restraint joint gaskets with an OWNER approved manufacturer design may be used in place of, or in addition to concrete thrust restraints with prior approval of the OWNER.

**3.6 CLEAN UP**

After completing each section of water line, all debris and construction materials shall be removed from the work site. Then the surface shall be graded and smoothed on both sides of the line. The entire area shall be left clean and in a condition satisfactory to the OWNER. The CONTRACTOR shall keep clean-up operations as close to active pipe laying as practical, generally following by less than 300 feet, or as approved by the OWNER.