Section 3

Water Services - Crosslinked Polyethylene (PEXa) Tubing
and
Water Mains - High Density Polyethylene Pipe (HDPE)

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3.01 Water Services - Crosslinked Polyethylene (PEXa) Tubing 3 inches Diameter and Smaller

3.01.1 General

Crosslinked polyethylene (PEXa) tubing shall be allowed for use as potable water pipe where compatible with the specific conditions of the project. IRCDUS may require the use of material other than PEXa during construction permit review or by IRCDUS field personnel during construction if it is determined that PEXa pipe is unsuitable for the particular application.

3.01.2 Polyethylene (PEXa) Tubing

A. This specification requires PEXa to be designated as PEXa, high pressure peroxide method.

B. PEXa tubing shall comply with applicable requirements for extrusion compound PEXa plastic material as stated in AWWA Standard Specifications C904, or latest revision, and shall comply with the following:

1. Tubing shall have a working pressure of 200 psi at 73.4° F.

2. Tubing surfaces shall be glass smooth, and shall be free from bumps and irregularities. Materials must be completely homogeneous and uniform in appearance.

3. Tubing dimensions and tolerances shall correspond with values listed in ASTM D-2239, with a standard outside dimension ratio (SDR) of 9.

4. Tubing shall carry the following markings every (3) feet: Manufacturers' name or trademark, nominal size, PEXa 3306 (material designation) SDR (standard dimension ratio), POTABLE TUBING, ASTM F876/F877/F2080, CSA B137.5, NSF-pw, UP Code 200psi/73.4°F 100psi/180°F, manufacturing date and footage mark.

3.01.3 Joints

A. Joints for PEXa tubing shall be of the compression type or compression-sleeve type, utilizing a totally confined grip seal and coupling nut, unless otherwise approved by IRCDUS. Stainless steel tube stiffener inserts shall also be used for PEXa tubing services.

3.01.4 Installation

A. Backfill shall be free of rocks and debris.

B. Bending radius shall be large enough so that tubing is not crimped or damaged and so that the flow of water is not restricted. Manufacturers' minimum radius recommendations are to be utilized during installation of PEXa tubing.

C. PEXa tubing shall have ability for kink repair using a heat gun.

3.01.5 Marking

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See Trace Wire Details M-14 for specifications regarding installation.

B. Trace wire is required over or around all pipes.

C. Location tape is required over all pipes. Tape is to be installed 12" below proposed grade and additional tape adhered directly on top of the pipe if required by IRCDUS engineering.

A. Developer is responsible for compatibility between pipe materials, fittings and appurtenances.

B. The pipe manufacturer shall provide a warranty against manufacturing defects of material and workmanship for a period of ten (10) years after the final acceptance of the project by the IRCDUS. The manufacturer shall replace at no expense to IRCDUS any defective pipe material including labor within the warranty period.

3.02 Water Mains - High Density Polyethylene Pipe (HDPE) 4 inches in Diameter and Larger

3.02.1 General

A. HDPE pipe intended for conveying or transmitting potable water shall conform to AWWA Standard Specifications C906-15 (or latest revision).

B. Pipe shall be Ductile Iron Pipe Size (DIPS) and SDR 11 with a pressure rating of 200 psi.

C. HDPE pipe shall be made from a PE 4710 resin compound conforming to ASTM D3350 with the cell classification 445574/4C/E.

D. Dimensions and workmanship shall be as specified by ASTM F714. HDPE fittings and transitions shall meet ASTM D3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.

E. If rework compounds are required, only those generated in the manufacturers' own plant from resin compounds of the same class and type from the same raw material supplier shall be used.

F. The pipe manufacturer must certify compliance, with the above requirements.

G. HDPE flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturers' specified torques. Bolts shall be tightened alternatively and evenly.

H. HDPE pipe shall be striped blue for potable water, green for wastewater, and purple for reclaimed/reuse water.

I. HDPE pipe shall be in accordance with IRCDUS Approved Manufacturers' Products List or equal.

3.02.2 Fittings

A. All molded fittings and fabricated fittings shall be fully pressure rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No fabricated fittings shall be used unless approved by IRCDUS.

B. The manufacturer of the HDPE pipe shall supply or specify all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the drawings and specified herein.

C. All transitions from HDPE pipe to PVC or ductile iron shall be made per the HDPE, PVC, or ductile iron pipe manufacturers' recommendations and specifications whichever is more stringent. A molded flange connector adapter within a carbon steel back-up ring assembly shall be used for pipe type transitions. Ductile iron back-up rings shall mate with cast iron flanges per ANSI B16.1. A 316 stainless steel back-up ring shall mate with a 316 stainless flange per ANSI B16.1.

D. The pipe manufacturer must certify compliance with the above requirements.

3.02.3 Joints

A. The HDPE pipe shall be joined with butt, heat fusion joints. All joints shall be made in strict compliance with the manufacturers' recommendations.

B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipes so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard lay lengths not to exceed 50 feet.

C. All above ground HDPE pipe shall have flange adapters. Below ground shall be MJ adapters. Stainless Steel inserts allowed on water main only 4" to 6". FM 4" and larger MJ adapter only with no insert. Pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion resisting bolts and nuts of Type 316 Stainless Steel as specified in ASTM A726 and ASTM A307. All bolts shall be tightened to the manufacturers' specified torques. Bolts shall be tightened alternatively and evenly.

3.02.4 Pipe Identification

A. The following shall be continuously indent printed on the pipe or spaced at intervals not exceeding 5-ft.

1. Name and/or trademark of the pipe manufacturer.
2. Nominal pipe size and OD base.
3. Material Code
4. Dimension ratio.
5. Pressure Class

6. Current AWWA C906 (if Applicable)
7. Manufacturing standard reference, e.g., ASTM F714 or D-3035, as required.
8. A production code from which the date and place of manufacture can be determined.

B. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of all pipe and fittings. See Trace Wire Details Drawing M-13 for specifications regarding installation.

3.03 Installation by Open Cut Method

A. HDPE Pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall do all heat fusion joints.

B. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer of Record and IRCDUS. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.

C. Under no circumstances shall the pipe or accessories be dropped into the trench.

D. Care shall be taken during transportation of the pipe such that it will not be cut, kinked, or otherwise damaged.

E. Ropes, fabric, or rubber protected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.

F. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects, which could damage the pipe. Stacking of the PE pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

G. Care shall be exercised when lowering pipe into the trench to prevent damage or twisting of the pipe.

H. Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill as shown on the Drawings.

I. When installation of pipe is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.

J. Pipe shall be stored on clean level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of wall thickness. Sections of pipe with cuts, scratches or gouges exceeding five percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined. The interior pipe surface shall be free of cuts, gouges or scratches.

K. HDPE pipe shall be joined by the method of thermal butt fusion, as outlined in ASTM D2657. All joints shall be made in strict compliance with the manufacturers' recommendations.

L. Mechanical connections of the HDPE pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:

1. An HDPE flange shall be thermally butt-fused to the stub end of the pipe. A stainless steel or ductile iron back-up ring shall be used on both sides of the connection prior to thermally butt-fusing the PE flange.
2. A 316 stainless steel back-up ring shall mate with a 316 stainless steel flange.
3. Ductile iron back-up rings shall mate with cast iron flanges.

M. Flange connections shall be provided with a full-face neoprene gasket.

N. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.

O. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.

P. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner. All pipe and fittings shall be thoroughly cleaned before

installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.

Q. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Construction Plans. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed to 12-in above the top of the pipe. The initial 3 feet of backfill above the bedding shall be placed in 1 foot layers and carefully compacted. Generally, the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. The pipe manufacturers' representative prior to use shall approve equipment used in compacting the initial 3 feet of backfill. Pipe shall be installed per IRCDUS Drawing M-1 or M-2, Trench Details.

R. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in crossing of utilities that may be encountered upon opening the trench.

S. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has cramped.

T. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.

U. Precautions shall be taken to prevent flotation of the pipe in the trench.

V. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be used in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below the top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be

placed to fill any voids created and the backfill shall again be compacted to provide uniform side support for the pipe.

W. Sheeting and shoring will be required as determined in the field in accordance with OSHA regulations.

3.04 Marking

A. Number 10 stranded conductor copper trace wire shall be spiral wrapped or affixed to the top of the pipe. See Trace Wire Details, M-13 for specifications regarding installation.

B. Trace wire is required over or around all pipes.

C. Location tape is required over all pipes. Tape is to be installed 12" below proposed grade and additional tape shall be adhered directly on top of the pipe if required by IRCDUS.

3.05 Trenchless Installation of High Density Polyethylene (HDPE) Pressure Mains by Horizontal Directional Drill (HDD)

A. Description

1. Portions of the pressure mains shall be installed by the directional bore method within the limits indicated of the contract plans and as specified here in. Generally, as a minimum, the pressure main is to be located within the road right-of-way and shall be installed by directional boring.

2. This section includes material, performance and installation standards, and the contractor's responsibilities associated with the furnishing of labor, material, equipment, and identical required to install, complete, required trenchless installation of pressure mains, as shown on the Drawings and as specified herein.

B. Experience

1. The Contractor must demonstrate expertise in trenchless method by providing a list of ten utility references for which similar work has been performed in the last two years. The references should include a name and phone number where the contact can be made to verify the Contractor's capability. The Contractor must provide documentation showing successful completion of the projects used for reference. Conventional trenching experience will not be considered applicable.

2. Supervisory personnel must be adequately trained and shall have at least four years of experience in directional boring. The Contractor shall submit the names and resumes of all supervisory field personnel prior to construction.

3. Directional boring equipment shall be capable of installing the minimum pipe diameter noted on the drawings.

C. Submittals

1. Submit technical data for equipment including clay slurry material, method of installation with working drawings, and proposed sequence of construction for approval by the IRCDUS.

2. Prior to approval for directional boring, the Contractor must submit the names of supervisory personnel, and history information of the directional boring experience. In addition, the Contractor must submit for approval the nameplate, data for the drilling equipment, mobile spoils removal units and Material Safety Data Sheets (MSDS) for the drilling slurry compounds.

3. The Contractor is required to bring to the attention of the engineer any known design discrepancies with actual tunneling methods that the contractor will be performing. This shall be stated in writing to the Engineer at the pre-construction meeting.

D. Installation

1. Installation shall be in a trenchless manner producing continuous bores.

2. The tunneling system shall be remotely steerable and permit electronic monitoring of tunnel depth and location. Accurate placement of pipe within a +/- 2-inch window is required both horizontally and vertically. Turning capability of 90-degrees radius in 40 feet is required. Continuous monitoring of the boring head is required, including across open water if necessary.

3. The directional boring Contractor shall submit certification, by a Professional Engineer licensed in the State of Florida, that the directional boring has been performed in accordance to the construction drawings, and shall submit signed and sealed drawings. AS-Built Record Drawings shall be provided both in electronic format and hard paper copy.

4. Tunneling shall be performed by a fluid-cutting process (high pressure-low volume) utilizing liquid clay i.e. bentonite. The clay lining will maintain tunnel stability and provide lubrication in order to reduce frictional drag while the pipe is being installed. In addition, the clay fluid must be totally inert and contain no environmental risk. The Contractor must also have a mobile vacuum spoils recovery vehicle on site to remove the drilling spoils from the access pits. The spoils must then be transported from the job site and be properly disposed off the site. The drilling spoils shall not, under any circumstances, be disposed into a sanitary sewer, storm, or other public or private drainage system. Spoils may be transported to the County's Solid Waste Facility and the cost of disposal shall be at the Contractor's expense.

5. Liquid clay type colloidal drilling fluid shall consist of at least 10 percent of high-grade carefully processed bentonite to consolidate cuttings of the soil, to seal the walls of the hole, and to furnish lubrication for subsequent removal of cuttings. The slurry that is heavier than the surrounding material, is high in colloids of the bentonite type and it will deposit a thin filter cake of low permeability material on the walls of the bore. This will allow only a small amount of the fluid to pass into the surrounding soils and will stabilize the bore. The colloidal content of the fluid imparts excellent lubricating qualities to the slurry that is a distinct aid to the removal of the soil cuttings.
6. Pneumatic or water-jetting methods will be considered unacceptable due to the possibility of surface subsidence.

7. After an initial bore has been completed, a reamer will be installed at the termination pit and the pipe shall be pulled back to the starting pit. The reamer shall be capable of discharging liquid clay to facilitate the installation of the pipe into a stabilized and lubricated tunnel.
8. A minimum of two insulated #6 stranded conductor copper tracer wire shall be wrapped or affixed to the top of the pipe and fittings along with the HDPE pipe. The tracer wire shall be tested for continuity or traceability upon completed installation. Should both tracer wires fail to test for continuity then the test shall be considered a failure and the wires shall be replaced.

9. Upon completion of boring and pipe installation, the Contractor shall remove all spoils from the starting and termination pits. All pits shall be restored to their original condition.

10. Restoration shall be as required by IRCDUS. The shoulders, ditches, banks, and slopes of roads and railroads crossed and paralleled shall not wash out before becoming accepted.

END OF SECTION