CITY OF FORT WAYNE MASTER UPDATED: 03/12/2018

SECTION

NTS: This Section is for use on watermain and sanitary sewerage force main projects. Section is for solid wall HDPE utility pipe only.

This section contains detailed descriptive requirements of the product(s) of the named manufacturer(s). If the product of another manufacturer is to be included, this section may require editing.

Coordinate this section with applicable requirements of Division 33 installation. Installation and jointing methods are included in the applicable piping installation section. Trenching and backfill information is in 33 00 05 Trenching and Earthwork.

1. GENERAL
	1. DESCRIPTION
		1. Scope:
			1. Contractor shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, test, and install the High Density Polyethylene (HDPE) utility pipe and fittings as shown and specified.
		2. Coordination:
			1. Review installation procedures under other Sections and coordinate the installation of items with, or before, the HDPE utility pipe Work.
		3. Related Sections:

NTS: List below only sections covering products, construction, and equipment specifically identified in this section and specified in another section and directly referenced in this specification. Do not list administrative and procedural Division 01 sections. Insert at (--1--) the number and name of the Division 33 installation section or any other referenced sections.

* + - 1. Section 31 00 05, Trenching and Earthwork.
			2. Section 33 05 33, Ductile Iron Pressure Utility Piping.
			3. Section 33 12 00, Water Appurtenances.
			4. Section (--1--).

NTS: Section “1.2” is to be included if project is bid on unit price basis. Section to be deleted or revised if project is to be bid on lump sum basis.

NTS: Insert at (--1--), (--2--) and (--3--) below the various pressure HDPE pipe types, DR designation, and diameters to be used for project. Adjust Section “1.2” below for additional work item numbers as needed. In extreme cases consider separating the work items by diameter and depth.

NTS: This work item description is specific to HDD installation, if project requires a different installation, methods edit as needed.

* 1. MEASUREMENT AND PAYMENT
		1. HDPE Pipe
			1. Work Item Number and Title

 **33 05 38.16-A (--1--) HDPE Pressure Utility Piping**

 **33 05 38.16-B (--2--) HDPE Pressure Utility Piping**

 **33 05 38.16-C (--3--) HDPE Pressure Utility Piping**

NTS: Edit paragraph 2 below to suit the Project. for watermain projects consider editing the specific structures to measure from.

* + - 1. The quantity of pipe installed shall be the number of linear feet actually installed, backfilled, and tested as measured, from outside wall of structure to outside wall of structure along the centerline of the pipe.

NTS: Edit paragraph 3 below to suit the Project. For projects where restoration of the surface is to be paid for separately add in the following second sentence. “Payment for any associated restoration shall be paid for under its respective Work item.”

* + - 1. The payment of pipe shall be based on the unit price per linear foot as listed on the submitted Bid schedule for each pipe size successfully installed.

NTS: Review paragraph 4 below and edit to suit project. For non-water projects remove work item “disinfection” and “incidentals required for air gap” if not required for project.

* + - 1. These Work items shall include all costs to furnish all labor, materials, tools, and equipment, both permanent and temporary, to install the HDPE pipe as shown and specified. The Work includes, but is not limited to, trench excavation, pavement removal and disposal if necessary, dewatering, furnishing and placement of bedding, pipe, pipe installation, fusion jointing of pipe lengths, placement of required backfill, special backfill, compaction of bedding and backfill, utility verification, disposing of excess excavated material, testing of materials, temporary sheeting, shoring and bracing, tracing wire, pressure testing, disinfection, incidentals required for air gap, surface restoration, restoration/replacement of all disturbed items not included under other Work items, protection of existing utilities and structures, and incidentals for performing all Work as specified unless otherwise provided for as a separate Work item. Restraint of mains not associated with fittings shall also be included in the unit price for the main. Incidental costs associated with HDD installation are included in this item. The furnishing and installation of fittings is not included under this item.
			2. Up to 10% of the total pipe length may be installed by open excavation. Costs associated with open excavation are included in this item and will not be paid for separately.

NTS: Insert at (--1--), through (--5--) below the various HDPE pipe fittings diameters to be used for project. Add additional work item numbers as needed. Delete if not required for project Adjust Section “1.2 B.” below for additional work item numbers as needed.

* + 1. HDPE Fittings
			1. Work Item Number and Title

**33 05 38.16- D (--1--) 11.25, 22.5, 45 or 90 Degree Bend HDPE Fittings**

**33 05 38.16- E (--2--) x (--3--) x (--4--) Tee HDPE Fittings**

**33 05 37.18-F (--5--) x (--6--) Reducer HDPE Fittings**

**33 05 37.18-G (--7--) Cross HDPE Fittings**

* + - 1. The number of fittings to be measured for payment shall be the actual number installed of each size and type as shown and specified along a pipe that is successfully installed, pressure tested and disinfected.
			2. The payment for these items shall be based on the unit price as listed on the submitted Bid schedule. Payment for special backfill will be under its respective Work item. Payment for excavation, disposal of excavated materials, bedding, restoration, and pressure testing and disinfection shall be included under the Work items for the pipe unless otherwise broken down by the Engineer as a separate Work items.
			3. These Work items shall include all costs to furnish all labor, materials, tools and equipment, both permanent and temporary, to install and maintain the fittings as shown and specified unless otherwise directed by the Engineer.
	1. REFERENCES

NTS: Retain all applicable standards below and add/delete as required. Delete paragraph “A.3” if not a potable water project.

* + 1. Standards referenced in this Section are listed below:
			1. American Society for Testing and Materials, Inc., (ASTM).
				1. ASTM D3261, Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
				2. ASTM D3350, Specification for Polyethylene Plastics Pipe and Fittings Materials.
				3. ASTM F714, Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Outside Diameter.
				4. ASTM F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled polyethylene and Crosslinked Polyethylene (PEX) Pipe and Tubing.
				5. ASTM F2206, Standard Specification for Fabricated Fittings of Butt-Fused Polyethylene.
				6. ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
				7. ASTM F2880, Standard Specification for Lap-Joint Type Flange Adaptors for Polyethylene Pressure Pipe in Nominal Pipe Sizes 3/4 in. to 65 in.
			2. American Water Works Association.
				1. AWWA C901, Polyethylene (PE) Pressure Pipe and Tubing, 1/2-inch through 3-inch, for Water Service.
				2. AWWA C906, Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch, for Water Distribution.
				3. AWWA M55, PE Pipe – Design and Installation.
			3. National Fire Protection Association
				1. NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
			4. National Science Foundation.
				1. NSF/ANSI Standard 61, **Drinking Water System Components - Health Effects.**
			5. Plastic Pipe Institute.
				1. PPI TR-4: **PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe.**
				2. **PPI TN-38, Bolt Torque for Polyethylene Flanged Joints.**
	1. QUALITY ASSURANCE

NTS: Edit or delete Paragraph "A" below, if project requirements prohibits experience clause.

* + 1. Manufacturer’s Qualifications:
			1. Manufacturer shall have a minimum of 5 years’ recent experience producing HDPE pressure pipe and fittings for at least the specified sizes and lengths, and shall be able to submit documentation of at least 5 installations in satisfactory operation for at least 5 years.
			2. HDPE pipe and fittings manufacturers and distributors shall be listed as current members of the Plastics Pipe Institute (PPI).
			3. Contractor shall have a minimum of 5 year’ recent experience installing HDPE pressure pipe and fittings for at least the specified pipe and fittings sizes and lengths and shall be able to submit documentation of at least 5 installations in satisfactory operation for at least 5 years.
			4. Fusion operators shall have received current training and certification per PPI TN-42.
		2. Component Supply and Compatibility:
			1. All pipe and fittings of each material type shall be furnished by the same manufacturer.
			2. The HDPE utility pipe and fittings manufacturer shall review and approve or prepare all Shop Drawings and other submittals for all components furnished under this Section.

NTS: Edit or delete Paragraph “C.” below, if not required. Paragraph “C” is intended for potable water use.

* + 1. Regulatory Requirements:
			1. Pipe and fittings, including linings and coatings, that will convey potable water or water that will be treated to become potable, shall be certified by an accredited organization in accordance with NSF 61 as being suitable for contact with potable water, and shall comply with requirements of authorities having jurisdiction at Site.
	1. SUBMITTALS

NTS: Review Paragraph “A” and “B” below and modify or eliminate to suit the project. Piping layout should only be requested for special circumstances such as areas where pipe restraint is required.

Submit fusion and EF parameters, test report.

* + 1. Action Submittals: Submit the following:
			1. Product Data:
				1. Submit product data on pipe, fittings, gaskets, hardware, and appurtenances sufficient to demonstrate compliance with the Contract Documents.

NTS: Delete Section “B.1.b” below if HDPE piping system is used for sewer forcemain and will not be in contact with potable drinking water.

* + 1. Informational Submittals: Submit the following:
			1. Certificates:
				1. Submit manufacturer’s certificate of compliance standards referenced in this Section.
				2. Submit manufacturer’s certificate of NSF 61 compliance for all components coming into contact with potable water.
				3. Submit contractor’s certificates of fusion, electrofusion operators training, and experience as described in Paragraph 1.4A.
				4. Submit fusion and EF parameters, test report.

NTS: Delete Section “2”. below if HDPE piping system is used for sewer forcemain and a electrofusion test is not required.

* + - 1. Generic Electrofusion Operator Training Test
				1. Submit completed test from Appendix C of the Municipal Advisory Board- Generic Electrofusion Procedure for Field Jointing of 12 Inch and Small Polyethylene (PE) pipe. Manual and test is located here: <http://www.plasticpipe.org/pdf/mab-generic-ef-110515.pdf>
			2. Source Quality Control Submittals:
				1. When requested by Engineer, submit results of source quality control tests. Ensure the quality control tests were completed on the same batch of material as installed.

NTS: Edit or delete Paragraph “3” below if project requirements prohibit an experience clause.

* + - 1. Qualifications Statements:
				1. Submit qualifications of manufacturer when requested by Engineer.
				2. Submit qualifications of installer when requested by Engineer.
		1. Post-Construction Submittals
			1. The following as-recorded data may be requested from the Contractor and/or fusion provider to the Owner upon request:
				1. Approved datalogger device reports
				2. Fusion joint documentation containing the following information:

Pipe Size and Thickness

Machine Size

Fusion Technician Identification

Job Identification

Fusion Joint Number

Fusion, Heating, and Drag Pressure Settings

Heat Plate Temperature

Time Stamp

Heating and Cool Down Time of Fusion

Ambient Temperature

* + - * 1. As-recorded Information

The as-recorded plan and profile will reflect the actual installed alignment, and reflect the horizontal offset from the baseline and depth of cover.

All fittings, valves, or other appurtenances will also be referenced and shown.

A daily project log, along with tracking log sheets, should they be used, shall be provided. Tracking log sheet data, should it be employed, shall include any and all that apply, including inclination, depth, azimuth, and hydraulic pull-back and rotational force measured.

* 1. DELIVERY, STORAGE, AND HANDLING
		1. Ship and store in accordance with manufacture’s recommendations.
		2. Inspect all materials during unloading process and before installation.
		3. Notify Owner of any cracked, flawed or otherwise defective material.
		4. Remove all materials from the Site that are found to be unsatisfactory.
		5. Handle pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense.
		6. Handle pipe carefully and use rollers to move system; avoid dragging system on ground or over sharp objects.
		7. Inspect delivered pipe for cracked, gouged, chipped, dented or other damaged material and immediately remove from site. Sections of pipe with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined.
		8. Comply with Section 01 65 00 Product Delivery Requirements and Section 01 66 00 Product Storage and Handling Requirements.
1. PRODUCTS
	1. MATERIALS

NTS: Edit Paragraph “A” to suit the project.

* + 1. General:
			1. Pipe materials shall be suitable for services intended.
			2. Pipe and fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, blisters, and other defects. Unless otherwise shown or indicated, pipe shall be uniform in color, opacity, density, and other physical properties.
			3. Buried pipe shall be capable of withstanding external live load, including impact, equal to AASHTO H-20 loading, with cover shown or indicated in the Contract Documents.
			4. Pipe, fittings, and appurtenances in contact with potable water or water that will be treated to become potable shall be listed in NSF 61 as being suitable for contact with potable water, and shall comply with requirements of the City of Fort Wayne, IN.
			5. Clean rework or recycled material generated by the manufacturer's own production may be used as long as the pipe or fittings produced meet all the requirements of this Section.
			6. Pipe shall be capable of withstanding a minimum recurring surge pressure (water hammer) flow velocity of 4 ft/sec, 55 cycles/day, and 100-year estimated fatigue life, or higher if shown in the Drawings. Occasional and fire flow velocity of 10 fps per NFPA 24.

NTS: HDPE pipe wall thickness DR 11 is specified below and is typically used for water and sewer project. Edit paragraph “B” if project requires different wall thickness.

* + 1. HDPE PIPE
			1. Dimensions:
				1. Pipe Dimensions: The nominal inside diameter of the pipe shall be true to the specified pipe size in accordance with AWWA C901 and/or AWWA C906 and/or ASTM F714.
				2. Wall thickness DR 11
				3. HDPE pipe shall be DIPS.
			2. The pipe shall meet the requirements of the applicable AWWA C901 and/or AWWA C906 and/or ASTM F714.
			3. Pipe shall be pressure rated to meet the service pressure requirements specified by Engineer.
			4. Pipe material used for the manufacture of HDPE shall be high density polyethylene (HDPE) having a material designation code of PE 4710 or higher, meeting the requirements of ASTM D3350 with a minimum cell classification of PE 445574C-CC3. Pipe material shall be listed in PPI TR-4 and NSF-61 (for potable water only) and have an allowable stress (HDS) of 1000 psi at 73°F.
			5. Only smooth wall HDPE will be permitted.

NTS: Maintain one paragraph “a” below based on project specific requirements.

* + - 1. Color:
				1. Watermain –Black with blue stripe

a. Sanitary – Black with green stripe

* + - 1. Approved manufacturers are: see list on plasticpipe.org.
			2. Physical Properties
				1. Materials used for the manufacture of polyethylene pipe and fittings shall meet the following physical property requirements:

 Property Unit Test Procedure Value

 1. Material Designation - PPI/ASTM -

 2. PPI Material Listing - PPI TR-4 PE 4710

 3. Material Classification - ASTM D 1248 III C 5 P34

 4. Cell Classification - ASTM D 3350 445574C-CC3

 5. Density g/cm3 ASTM D 1505 >0.941

 6. Melt Index (E) g/10 min ASTM D 1238 <0.15

 7. Flexural Modulus psi ASTM D 790 >110,000

 8. Tensile Strength psi ASTM D 638 <160,000

 9. ESCR (C) hours ASTM D 1693 3,000 to 3,500

 10. HDB psi ASTM D 2837 1,600 @ 23°C

 11. UV Stabilizer (C) %carbon black ASTM D 1603 2 to 3

 12. Elastic Modulus psi ASTM D 638 110,000

 13. Brittleness Temp F ASTM D 746 <-180

 14. Vicat Softening Temp F ASTM D 1525 255

 15. Thermal Expansion in/in/ F ASTM D 696 8 x 10E-5

 16. Hardness Shore D ASTM D 2240 64

 17. Molecular Weight Category - - Extra-High

* + - * 1. There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with Article 2.4, below.
				2. Ring Stiffness Constant (RSC) values for the pipe can be directly related to the pipe's class designation. (Nominal RSC of Class 40 pipe = 40, etc.). The minimum RSC is 90 percent of the nominal.

NTS: Delete Paragraph “C” below based on project specific requirements. The pipe material below is for water service lines, delete for sanitary or storm sewer projects that are not replacing water services.

* + 1. HDPE WATER SERVICE LINES
			1. Provide the following pipe material:
				1. CTS (copper tubing size) DR 9 HDPE, meeting the requirements of ASTM D2737, ASTM D3350, NSF-14, NSF-61, and AWWA C901.
				2. PE 4710 with min. cell classification of 445574C-CC3
				3. 250 psi min, working pressure.
				4. Color- Solid blue or black with a blue stripe.
				5. Tubing shall be printed labeled with manufacturer, diameter, outside diameter control, working pressure rating, and ASTM and NSF approval.
			2. Service line dimensions:
				1. Minimum size 1 inch
				2. Allowable service line sizes include 1-inch, 1.5-inch and 2-inch.

NTS: Edit Paragraph “D” below based on project specific requirements. Delete joint types that are not used as part of the project.

* + 1. HDPE JOINTS
			1. General:
				1. Joints shall be as specified in the Contract Documents.
			2. Butt Heat Fusion Joints:
				1. Shall be allowed for joining lengths of pipe in a straight run only.
				2. Shall conform to ASTM F2620 and PPI TR-33.
				3. Joint strength shall be equal to or greater than the strength of the pipe, as demonstrated by testing requirements.
			3. Electro- Fusion Couplings:
				1. Electro-fusion couplings shall contain heating coils located at the sealing surface.
				2. The following are acceptable manufacturers:

GF Central Plastics

Plasson USA

* + - 1. Fused Mechanical Joint (MJ) Adaptors:
				1. Use mechanical joint (MJ) adaptors to connect HDPE pipe to ductile iron fittings and valves.
				2. Provide MJ adaptors with kit, manufactured in accordance with ASTM D3261. The adaptor shall consist of the following:

Molded HDPE MJ transition fitting

Rubber gasket

MJ backup ring

Corrosion resistant - Cor Blue bolts and nuts

* + - * 1. Fused mechanical joint (MJ) adaptors shall have a pressure rating equal to the pipe unless otherwise specified and be provided by:

GF Central Plastics

Plasson USA

NTS: Delete paragraph “5” below if not used for project. Flanged joints are for exposed piping and are not intended to be buried. Delete for buried water utility projects.

* + - 1. Flanged Joint Adaptors:
				1. Provide flanged adaptors with kit, manufactured in accordance with ASTM D3261. The adaptor shall consist of the following:

Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (or B or E), ASME/ANSI B 16.5 Class 150, ASME/ANSI B 16.1 Class 125, or ASME/ANSI B16.47 Series A.

* + - * 1. Flange adaptors shall meet the dimensional and material requirements of ASTM F2880.
				2. Flange assemblies shall be assembled and torqued according to PPI TN-38, “Bolt Torque for Polyethylene Flanged Joints.”
				3. Fused flanged adaptors shall have a pressure rating equal to the pipe unless otherwise specified and be provided by:

GF Central Plastics

Plasson USA

* + 1. Thrust Anchor:

NTS: Make sure location of Thrust Anchors are shown on the Drawings. If not edit Paragraph “a” below. Include the Thrust Anchor on the Drawings as required.

* + - * 1. Where shown on Drawings, connections to existing pipe shall use a thrust anchor.
				2. Concrete thrust collar shall be attached to the HDPE pipe using an electro-fusion flex restraint device. Refer to concrete thrust collar detail.
		1. HDPE FITTINGS THROUGH 12 INCH
			1. Provide HDPE fittings made of HDPE material designation same as the mainline pipe and complying with NSF Standard 61 and AWWA C906.
			2. Fittings shall be pressure class 200 rated.
			3. Molded HDPE fittings
				1. Fittings shall comply with the requirements of ASTM D3261.
				2. Fitting is externally reinforced and maintains the same inside diameter as DR 11 main line.
			4. The following are acceptable fitting manufacturers:
				1. GF Central Plastics
				2. Plasson USA
				3. Or Approved Equal
		2. HDPE FITTINGS GREATER THAN 12 INCH
			1. Provide HDPE fittings made of HDPE material designation same as the mainline pipe and complying with NSF Standard 61 and AWWA C906.
			2. Fittings shall be pressure class 200 rated.
			3. Fabricated HDPE fittings
				1. Acceptable in diameters greater than 12-inches or where a molded fitting is not manufactured.

NTS: Remove requirements of Paragraph “b” below if project is not concerned with slight increase in headloss, or if proposed pipe line will not need to be cleaned by pigging the main, or if full ID fittings are not required for project. Full ID fittings are the preferred type for all typical watermain projects. Pigging the main is a type cleaning method that typically utilizes a foam plug on the inside of the pipe.

Specifier should confirm availability of EDR11 fittings for proposed project.

* + - * 1. Fittings shall be equivalent diameter ratio 11 for full inside diameter (EDR-11). Fitting is externally reinforced and maintains the same inside diameter as adjacent main line. Fitting is fully pressure rated with full flow ID.
				2. Fittings shall comply with the requirements of ASTM F2206.
			1. The following are acceptable fitting manufacturers:
				1. GF Central Plastics
				2. Plasson USA
				3. Or Approved Equal
		1. HDPE BRANCH SADDLE REDUCING TEE
			1. Provide HDPE fittings made of HDPE material designation same as the mainline pipe and complying with NSF Standard 61 and AWWA C906.
			2. Fittings shall be pressure class 200 rated.
			3. Fabricated HDPE reducing tee:
				1. Fittings shall be equivalent diameter ratio 11 for full inside diameter (EDR-11). Fitting is externally reinforced and maintains the same inside diameter as adjacent main line. Fitting is fully pressure rated with full flow ID.
				2. Sidewall fusion performed by manufacturer.
				3. Fittings shall comply with the requirements of ASTM F2206.
			4. The following are acceptable fitting manufacturers:
				1. GF Central Plastics
				2. Plasson USA
				3. Or Approved Equal

.NTS: Remove Article “2.2 Electrofusion Saddles” below, based on project specific requirements.

* 1. ELECTROFUSION SADDLES
		1. Provide electrofusion saddles, refer to Section 33 12 00, Water Appurtenances.
	2. MARKING FOR IDENTIFICATION
		1. Marking:
			1. Each standard and random length of pipe in compliance with this specification shall be clearly marked with the following information that will remain legible during normal handling and storage and per AWWA C901 and/or AWWA C906.
				1. ASTM or AWWA Standard Designation.
				2. Pipe Size.
				3. Class and Profile Number.
				4. Production Code.
				5. Standard Dimension Ratio (SDR).
				6. Standard Material Code Designation.
	3. SOURCE QUALITY CONTROL
		1. At a minimum, incoming polyethylene materials shall be inspected for density in accordance with ASTM D 1505 and melt flow rate in accordance with ASTM D 1238. All incoming polyethylene materials shall be certified by the Supplier. Certification shall be verified by Contractor and submitted to Engineer. Incoming materials shall be approved by Manufacturer's Quality Assurance Program before processing into finished goods.
		2. Representative Samples of polyethylene materials shall be tested against the physical property requirements required herein. Each extrusion line and molding machine shall be qualified to produce pressure rated products by taking representative production Samples and performing sustained pressure tests in accordance with ASTM D 1598.
		3. Quality Assurance test for representative pipe and fitting Samples shall include:

 Test Standard Pipe Fittings

 Ring ESCR ASTM F 1248 Yes Not Applicable

 Sustained pressure at 176°F/725 psi hoop stress:

 (fo>100 h) ASTM D 1598 Yes Yes

 Sustained pressure at 73°F/1,600 psi hoop stress:

 (fo>1000 h) ASTM D 1598 Yes Yes

* + 1. The HDPE pipe and fitting manufacturer shall certify that Samples of their production pipe have undergone stress regression testing, evaluation, and validation in accordance with ASTM D 2837 and PPI TR-3. Under these procedures, the minimum hydrostatic design basis shall be certified by the pipe and fitting manufacturer to be 1,600 psi at 73.4°F and 800 psi at 140°F.
		2. Material shall be listed in the name of the HDPE pipe and fitting manufacturer as required by the Plastics Pipe Institute (PPI) in PPI TR-4 with the following Standard Grade ratings:

 73.4°F 140°F

 1. Hydrostatic Design Basis (HDB) 1,600 psi 800 psi

 2. Hydrostatic Design Stress (HDS) 800 psi 400 psi

PPI material listing in the name of the resin Supplier is not acceptable in meeting this requirement.

* + 1. Inspection Requirements:
			1. Certification: As the basis of the acceptance of the material, the manufacturer will furnish a certificate of conformance of these Specifications upon request.
			2. All outgoing materials shall be inspected for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut. Manufacturer's Quality Control Program shall perform tests of density, melt flow rate, carbon content, and carbon dispersion. In addition, Samples of the pipe provided shall be tested for hoop tensile strength and ductility by either quick burst in accordance with ASTM D 1599 or ring tensile strength in accordance with ASTM D 2290. Molded fittings shall be subject to x-ray inspection for voids, and tests for knit line strength. All fabricated fittings shall be inspected for fusion quality and alignment.
		2. Test Methods:
			1. Flattening: Three specimens of pipe, a minimum of 12-inches long, shall be flattened between parallel plates in a suitable press until the distance between the plates is 40 percent of the outside diameter of the pipe. The rate of loading shall be uniform and such that the compression is completed within two to five minutes. Remove the load, and examine the specimens for splitting cracking or breaking.
			2. Pipe Ring Stiffness Constant: The pipe ring stiffness constant shall be determined utilizing procedures similar to those outlined in ASTM D 2412. The stiffness of HDPE pipe is defined in terms of the load, applied between parallel plates, which causes one percent reduction of pipe diameter. Test specimens shall be a minimum of two pipe diameters or four feet in length, whichever is less.
		3. Pipe may be rejected for failure to conform to these Contract Documents or the following:
			1. Fractures or cracks passing through pipe wall, except single crack not exceeding 2 inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment shall be rejected if defects exist in more than five percent of shipment or delivery.
			2. Cracks sufficient to impair strength, durability or serviceability of pipe.
			3. Defects indicating improper proportioning, mixing, and molding.
			4. Damaged ends, where such damage prevents making satisfactory joint weld.
			5. Gouges or scrapes exceeding ten percent of the specified wall thickness.
	1. BURIED PIPING IDENTIFICATION

NTS: Coordinate project specific tracing wire requirements with Section 33 11 00, Water Piping Installation or 33 31 00, Sanitary Sewer Piping Installation. Insert at (--1--) the appropriate piping installation spec section.

* + 1. Provide piping tracing wire; refer to Section (--1--).
1. EXECUTION
	1. INSPECTION
		1. Inspect pipe materials for defects in material and workmanship. Verify compatibility of pipe and fittings.
		2. Defective, damaged, or unsound pipe will be rejected. Cuts, punctures, or gouges that penetrate or reduce the wall thickness by 10-percent or more are not acceptable and must be removed and discarded.
		3. Out of Round Pipe:
			1. Re-round pipe with appropriate re-rounding tools as provided by the pipe manufacturer.
			2. Squeeze tools are not acceptable for use on pipe.
	2. PIPE HANDLING
		1. Handle pipe in a manner to protect pipe from damage by dragging it over sharp and cutting objects. Do not drag pipe along gravel, asphalt or concrete pavement.
		2. Protect pipe from damage during installation operations. Do not damage pipe with chains, cables, wire ropes, and hooks.
	3. INSTALLATION
		1. Buried Piping Installation
			1. Refer to the applicable Division 33 piping installation section.

NTS: Delete Section B below if HDD installation is not used on project.

* + 1. Horizontal Directional Drilling Installation
			1. Refer to Section 33 05 23.13 Utility Horizontal Directional Drilling
		2. Bedding and Backfill
			1. Refer to Section 31 00 05 Trenching and Earthwork.

NTS: Specifier to consider known construction sequencing and procedures when determining pipe design. Heavy construction loading should be avoided for installed pipes with shallow cover.

* + 1. Contractor shall be responsible for verification of pipe loading during construction. Pipe design is based on final installation depth and required cover.

NTS: Coordinate article “3.3” below with project specific testing requirements listed within Section 33 11 00, Water Piping Installation. Edit the installation specification reference if a different installation (sanitary, storm) section is used. Ensure that the installation section has the applicable requirements.

* 1. BURIED PIPING IDENTIFICATION INSTALLATION

NTS: Coordinate project specific tracing wire requirements with Section 33 11 00, Water Piping Installation or 33 31 00, Sanitary Sewer Piping Installation. Insert at (--1--) the appropriate piping installation spec section. Delete if not required.

* + 1. Install piping tracing wire; refer to Section (--1--).
	1. FIELD QUALITY CONTROL

NTS: Insert at (--1--) the appropriate piping installation spec section.

* + 1. Leakage Testing
			1. Complete pipe leakage testing; refer to Section (--1--).

NTS: Delete paragraph “B” if this is a sanitary sewer force main.

* + 1. Disinfection
			1. Complete pipe disinfection; refer to Section-33 11 00, Water Piping Installation.

+ + END OF SECTION + +