Design Standard

High Density Polyethylene (HDPE) Piping Installations

This standard was revised on March 23, 2021, and the latest changes are underlined. Please refer to Part 4 of this standard for full revision history.

PART 1 GENERAL

Texas A&M University requires the use of Extra High Molecular Weight Plus (EHMW Plus) High Density Polyethylene (HDPE) pipe due to its additional performance against abrasion, higher pressure and elevated temperatures. This pipe is manufactured with the PE4710 resin. For chilled water and domestic cold water a minimum of SDR 17 is required. For heating water and domestic hot water a minimum of SDR 11 is required. For sanitary sewer a minimum of SDR 26 is required (SDR 17 is recommended under mall and paver areas). For heating water, all pipe shall be “DOW 2499 Water” per the specification in Appendix A (attached).

The following standards and practices shall be adhered to:
Polyethylene fabricated fittings shall be manufactured from polyethylene pipe, sheet stock or molded fittings meeting the material requirements of this specification and all appropriate requirements of AWWA C-901 or AWWA C-906.

Polyethylene fittings, including custom fabrications, shall have the same internal pressure rating as the mating pipe. At the point of fusion, the wall thickness and outside diameter of the fitting shall be in accordance with AWWA C-901 or AWWA C-906 for the same pipe size.

For campus buildings served by TAMU central thermal distribution systems, supply and return lines typically have piping with identical size and material for each system - chilled water (CHW), heating hot water (HHW), and domestic hot water (DHW). Because these thermal distribution lines are identical in size and appearance for each thermal system, there is the potential for cross-connection between supply and return. To avoid possible cross-connection of supply and return lines, design engineers shall require field verification in construction documents and contractors shall field verify the configuration of supply and return lines, using an appropriate temperature sensing device and adequate system flow, before making building connections. Any discrepancy between construction documents and field verification should be promptly reported to the project A/E and the Owner’s representative before completing piping installation, so proper piping configuration can be verified.

An isolation valve shall be installed on any lateral feeding a building so that the building can be isolated without bringing down adjacent buildings. The valve shall be a direct buried gate valve.¹

Victaulic products for HDPE pipe may be used only as a replacement for necessary flanges not as replacement for fusion in pipe runs that can be fused.⁴ HDPE products are rated to pressures equal to the pipe with which they are used. (The pipe manufacturer’s listing is dependent upon wall thickness, pipe composition and temperature.) Victaulic couplings, transition couplings, and pipe flange adaptors may be used. Where possible use Victaulic installation-ready design which permits direct “stab” installation without prior disassembly of the couplings. Gaskets shall be molded and produced by the
coupling manufacturer and suitable for intended service. Assembly of HDPE couplings and flange adapters shall be in accordance with latest published specifications.

PART 2 JOINING

2.01 Heat Fusion

A. Pipe and fittings shall be joined by one of the following types of thermal fusion per the Manufacturer’s recommended procedures: Butt fusion, Saddle fusion or Socket fusion.

B. All fusion joints shall be prepared using a data logging system. Each joint shall be uniquely identified with a permanent marker. The data log shall include:

1. Operators initials.
2. Date and time of fusing.
3. Pre-heat temperature and duration (if used).
4. Fusing pressures, temperatures, and duration.
5. Ambient air temperature.
6. Geo-reference for location of fused joint. This geo-reference shall be updated after the completion of laying the pipe.

C. Upon request, the Manufacturer shall provide fusion training by authorized personnel or an authorized Representative. The Contractor shall be responsible for ensuring that personnel have received proper training per the Manufacturer’s recommended procedure. Records of training shall be maintained by the Contractor and should not exceed 12 months from date of construction.

D. Butt fusions performed between pipe ends or pipe ends and fitting outlets shall be within the following allowable wall mismatches:

1. 2 DR difference for pipe and fitting diameters 6"IPS and smaller.
2. 1 DR difference for above 6" through 18".
3. No difference for diameters above 18".

The difference in DR’s is determined from the following DR values: 7.3, 9, 11, 13.5, 17, 21, 26 and 32.5

2.02 Other Methods of Joining (when heat fusion techniques cannot be performed)

A. Polyethylene pipe and fittings may be joined together or to other materials through the use of electrofusion fittings, flange adapters with back-up rings, mechanical couplings designed for connecting polyethylene pipe and fittings to itself or to another material, or MJ adapters. The Manufacturer of the joining device shall be consulted for proper
installation procedures. These other joining methods can be used when transitioning HDPE to other non-HDPE piping materials, but cannot be used to join sections of HDPE material without written approval from the Utilities and Energy Services (UES) Manager for Engineering and Project Management (EPM). HDPE materials shall be joined by approved fusion techniques or approved HDPE flanging techniques. 5

2.03 Third Party Certification
A. The performance requirements of the pipe and fittings shall comply with the most current version of AWWA C-901 or AWWA C-906. The Manufacturer shall be listed with NSF-61 certification and include the third party certification within the print line of the product.

PART 3 INSTALLATION

3.01 Marking
A. Pipe and tubing shall be permanently marked in accordance with all applicable standards per this specification. Marking shall be heat stamped indent print and shall remain legible under normal handling and installation practices.

B. Fittings shall be marked on the body or hub. Marking shall be in accordance with the applicable standard depending upon the fitting type. Mechanical fittings shall be marked with size, body material designation code, pressure rating and the Manufacturer’s name or trademark.

3.02 Thermal lines shall be insulated in accordance with the Underground Piping Systems Design Standard. All uninsulated lines shall have the following bedding materials:

- Under paved areas – 6” of bedding sand and 6” sand cover with remaining to be 2% stabilized sand to subgrade.

  **Note:** Avoid direct contact between HDPE pipe and stabilized sand.

- Under non-paved areas – 6” bedding sand with remainder of back fill to be select fill.

3.03 Pipe, tubing and fittings shall be homogenous throughout, and free of visible cracks, holes, foreign inclusions, blisters, dents or other injurious defects. The pipe, tubing and fittings shall be as uniform as commercially practicable in color, opacity, density and other physical properties.

3.04 TESTING
A. The Contractor shall be responsible for field set-up and performance of the fusion equipment and the fusion procedure used by the operator. Upon request, the Contractor shall verify the fusion quality by making and testing per the Manufacturer’s recommended qualification procedure. The Contractor shall be responsible for the necessary adjustments to the set-up, equipment, operation, and fusion procedure. Fusions that fail the qualification procedure shall be remade.
B. Hydrostatic testing shall be conducted in accordance with the Manufacturer’s recommended testing procedures. Hydrostatic testing shall be performed prior to installation of the insulation and backfill. At no time shall the pipe be covered prior to the completion of the hydrostatic testing. Hydrostatic test pressures for main campus shall be 100 psi for chilled and heating water piping, 125 psi for domestic cold and hot water lines. Acceptance shall be zero pressure drop after 2 hours.

C. Low pressure pneumatic testing may be conducted on gravity sewer lines in accordance with ASTM F1417. Other methods of pneumatic testing are not recommended.

D. A detectable “Caution-Buried Water Line” tape shall be placed 18” to 24” above each line.

PART 4 REVISIONS TO DESIGN STANDARD

<table>
<thead>
<tr>
<th>Revision #</th>
<th>Date</th>
<th>Location</th>
<th>Brief Description</th>
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<tbody>
<tr>
<td>1</td>
<td>5/12/2017</td>
<td>Part 1</td>
<td>Isolation valve added to standard</td>
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<tr>
<td>2</td>
<td>8/18/2017</td>
<td>Part 2</td>
<td>Section 2.01B added to standard. Previous sections 2.01B and 2.01C moved to 2.01C and 2.01D, respectively.</td>
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<td>3</td>
<td>7/15/2020</td>
<td>Part 1</td>
<td>Victaulic products added to standard</td>
</tr>
<tr>
<td>4</td>
<td>3/2/2021</td>
<td>Part 1</td>
<td>Victaulic specifications changed</td>
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<tr>
<td>5</td>
<td>3/23/2021</td>
<td>Part 2.02</td>
<td>Other joining methods must be approved by UES EPM</td>
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APPENDIX A
INTREPID 2499 NT TECHNICAL INFORMATION
INTREPID™ 2499 NT
Bimodal Polyethylene Resin

Overview
INTREPID™ 2499 NT Bimodal Polyethylene Resin is a Polyethylene resin produced using UNIPOL II process technology. This product is intended for use in industrial piping systems where extreme conditions such as high temperatures, aggressive chemicals, hydrocarbons, or highly oxidative conditions exist. Suitable uses include oil and gas field pipelines, gas distribution pipelines, and other industrial applications.

Industrial Standards Compliance:
- ASTM D 3350: cell classification PE445574A
- Plastics Pipe Institute (PPI): TR-4
  - Natural Pipe INTREPID™ 2499 NT Bimodal Polyethylene Resin
    • ASTM PE4710 pipe grade - 1600psi HDB @ 73 °F (23°C)
    • ASTM PE4710 pipe grade - 800psi HDB @ 180 °F (82.2°C)

Additive
- Antblock: No
- Slip: No
- Processing Aid: Yes

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<tr>
<th>Physical</th>
<th>Nominal Value (English)</th>
<th>Nominal Value (SI)</th>
<th>Test Method</th>
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<tr>
<td>Density (Natural)</td>
<td>0.950 g/cm³</td>
<td>0.950 g/cm³</td>
<td>ASTM D792</td>
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<tr>
<td>Melt Mass-Flow Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>190°C/2.16 kg</td>
<td>0.10 g/10 min</td>
<td>0.10 g/10 min</td>
<td>ASTM D1238</td>
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<td>190°C/21.6 kg</td>
<td>7.0 g/10 min</td>
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<tr>
<td>Tensile Strength (Yield)</td>
<td>&gt; 3500 psi</td>
<td>&gt; 24.1 MPa</td>
<td>ASTM D638 1</td>
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<tr>
<td>Tensile Elongation (Break)</td>
<td>&gt; 500 %</td>
<td>&gt; 500 %</td>
<td>ASTM D638 1</td>
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<tr>
<td>Flexural Modulus</td>
<td>152000 psi</td>
<td>1050 MPa</td>
<td>ASTM D790B 2, 1</td>
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| Resistance to Rapid Crack Propagation, Pc - S-4 |                         |                    | ISO 13477 3 |
| 32°F (0°C)                                     | > 174 psi               | > 12.0 bar         |             |

| Resistance to Rapid Crack Propagation, Tc - S-4 |                         |                    | ISO 13477 3 |
| 145 psi (10 bar)                               | < 2 °F                  | < -17 °C           |             |

| Slow Crack Growth PENT - @ 2.4 MPa            |                         |                    | ASTM F1473 1 |
| 176°F (80°C)                                  | > 10000 hr              | > 10000 hr         |             |
| 194°F (90°C)                                  | > 10000 hr              | > 10000 hr         |             |

<table>
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<th>Test Method</th>
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<tr>
<td>Notched Izod Impact (73°F (23°C))</td>
<td>9.1 ft lb/in</td>
<td>490 J/m</td>
<td>ASTM D256A 1</td>
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<th>Test Method</th>
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<tr>
<td>Britteness Temperature</td>
<td>&lt;-103 °F</td>
<td>&lt;-75.0 °C</td>
<td>ASTM D746A 1</td>
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<tr>
<td>Melting Temperature (DSC)</td>
<td>269 °F</td>
<td>132 °C</td>
<td>Dow Method</td>
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<tr>
<td>Thermal Stability</td>
<td>&gt; 428 °F</td>
<td>&gt; 220 °C</td>
<td>ASTM D3350</td>
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</table>

Extrusion Notes

Fabrication Conditions:
- Screw Type: High quality HDPE barrier with mixing
- Melt Temperature Range: 380-450°F (193-232°C)

Notes
These are typical properties only and are not to be construed as specifications. Users should confirm results by their own tests.

1 Compression molded parts prepared according to ASTM D 1928 Procedure C. Properties will vary with changes in molding conditions and aging time.

2 Method I (3 point load)

3 Pipe diameter of 10 inch IPS (25.4 cm) and Standard Diameter Ratio (SDR) 11.
High Density Polyethylene (HDPE) Piping Installations

Appendix A - INTREPID 2499 NT Technical Information

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