

**Standard Specification for
Corrugated Polyethylene Pipe,
1350 and 1500 mm Diameter**

AASHTO Designation: MP7-01^{1, 2}

1. Scope

1.1 This specification covers the requirements and methods of tests for corrugated polyethylene (PE) pipe, couplings, and fittings for use in surface and subsurface drainage applications. Nominal sizes of 1350 and 1500 mm are included. Materials, workmanship, dimensions, pipe stiffness, environmental stress crack resistance, joining systems, brittleness, and form of markings are specified.

1.2 Corrugated polyethylene pipe is intended for surface and subsurface drainage applications where soil provides support to its flexible walls. Its major use is to collect or convey drainage water by open gravity flow, as culverts, storm drains, etc.

Note 1 - When polyethylene pipe is to be used in locations where the ends may be exposed, consideration should be given to combustibility of the polyethylene and the deteriorating effects of prolonged exposure to ultraviolet radiation.

1.3 This specification does not include requirements for bedding, backfill, or earth cover load. Successful performance of this product depends upon proper type of bedding and backfill, and care in installation. A structural design of corrugated polyethylene pipe and installation procedures are given in the AASHTO Standard Specification for Highway Bridges. Upon request of the purchaser or engineer, the manufacturer shall provide profile wall section detail required for a full engineering evaluation.

2. Referenced Documents

2.1 ASTM Standards:

D618 Conditioning Plastics and Electrical

Insulating Materials for Testing
D638 Tensile Properties of Plastics
D883 Terms Relating to Plastics
D1693 Environmental Stress Cracking of Ethylene Plastics
D1928 Preparation of Compression-Molded Polyethylene Test Sheets and Test Specimens
D2122 Determining Dimensions of Thermoplastic Pipe and Fittings
D2412 Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
D2444 Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
D3350 Polyethylene Plastics Pipe and Fitting Materials
D5397 Evaluation of Stress Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
F412 Terms Relating to Plastic Piping Systems

2.2 AASHTO Standards:

Standard Specification for Highway Bridges

3. Terminology

3.1 The terminology used in this standard is in accordance with the definitions given in ASTM D883 and ASTM F412 unless otherwise specified.

3.2 Crack - Any break or split that extends through the wall.

3.3 Crease - An irrecoverable indentation, generally associated with wall buckling.

3.4 Buckling - Any reverse curvature or deformation in the pipe wall that reduces the load carrying capability of the pipe.

¹ This standard is based on limited research and usage by AASHTO member states.

² Approved in November 1997, this provisional standard was first published in June 1998. Changes in the standard were balloted and approved for publication in 2001.

3.5 Polyethylene (PE) plastics – Plastics based on polymers made with ethylene as essentially the sole monomer (ASTM D 883).

3.6 Reworked Plastic – a plastic from processor's own production that has been reground, pelletized or solvated after having been previously processed by molding, extrusion, etc., (ASTM D883).

3.7 Virgin Polyethylene Material – PE plastic material in the form of pellets, granules, powder, floc, or liquid that has not been subject to use or processing other than required for initial manufacture.

3.8 Slow Crack Growth – is a phenomenon by which a stress crack may form. A stress crack is an external or internal crack in plastic caused by tensile stresses less than its short-time mechanical strength (ASTM D 883).

4. Classification - The corrugated polyethylene pipe covered by this specification is classified as follows:

4.1 Type C - Pipe having a full circular cross-section, with a corrugated surface both inside and outside. Corrugations shall be annular.

4.2 Type CP - Type C pipe with perforations.

Note 2 - Two classes of perforations are described in Section 7.3.

4.3 Type S - Pipe having a full circular cross-section with an outer corrugated pipe wall and a smooth interior. Corrugations shall be annular

4.4 Type SP - Type S pipe with perforations (Note 2).

4.5 Type D - Pipe having an essentially smooth waterway braced circumferentially or spirally with projections or ribs joined to an essentially smooth outer wall. Both walls are fused to, or continuous with, the internal supports.

5. Ordering Information - Orders using this specification shall include the following information as necessary to adequately describe the desired product:

5.1 AASHTO designation and year of issue,

5.2 Type of pipe (see Section 4),

5.3 Diameter and length required, either total length or length of each piece and number of pieces,

5.4 Number of couplings,

5.5 Class of perforations (Class 2 is furnished if not specified) (see Section 7.3), and

5.6 Certification, if desired (see Section 12).

6. Materials

6.1 Extruded Pipe and Blow Molded Fittings - Extruded pipe and blow molded fittings shall be made of virgin PE compounds which conform with the requirements of cell class 335400C as defined and described in ASTM D3350, except that the carbon black content shall not exceed 5 percent, and the density shall not be less than 945kg/m^3 nor greater than 955 kg/m^3 . Compounds that have higher cell classifications in one or more properties with the exception of density are acceptable provided product requirements are met. For slow crack growth resistance, resins shall be evaluated using the single point notched constant tensile load (SP-NCTL) test according to the procedure described in Section 9.5. The average failure time of the five test specimens must exceed 24 hours with no single test specimen's failure less than 17 hours.

6.2 Rotational Molded Fittings - Rotational molded fittings shall be made of virgin PE compounds which conform with the requirements of cell class 213320C as defined and described in ASTM D3350, except that the carbon black content shall not exceed 5 percent. Compounds that have higher cell classifications in one or more properties are acceptable provided product requirements are met.

6.3 Reworked Plastic - In lieu of virgin PE, clean reworked plastic may be used by the manufacturer, provided that it meets the cell class requirements as described in Sections 6.1 and 6.2.

7. Requirements

7.1 Workmanship (visible defects) - The pipe and fittings shall be free of foreign inclusions, cracks, creases and unpigmented or nonuniformly pigmented pipe. The ends of the pipe shall be cut squarely and cleanly so as not to adversely affect joining or connecting.

7.1.1 For Type S pipe, the inner wall shall be fused to the outer corrugated wall at all internal corrugation crests.

7.1.2 For Type D pipe, both walls shall be fused to, or continuous with, the internal supports.

7.2 Pipe Dimensions

7.2.1 Nominal Size - The nominal size for the pipe and fittings is based on the nominal inside diameter of the pipe. Nominal diameters shall be 1350 and 1500 mm.

7.2.2 Wall Thickness - The inner wall of 1350 and 1500 mm, Type S pipe, and both inner and outer walls of 1350 and 1500 mm, Type D pipe, shall have a minimum thickness of 1.8 mm, when measured in accordance with Section 9.7.4.

7.2.3 Inside Diameter Tolerances - The tolerance on the specified inside diameter shall be 4.5 percent oversize and 1.5 percent undersize, but not more than 30 mm oversize when measured in accordance with Section 9.7.1.

7.2.4 Length - Corrugated PE pipe may be sold in any length agreeable to the user. Lengths shall not be less than 99 percent of the stated quantity when measured in accordance with Section 9.7.2.

7.3 Perforations - When perforated pipe is specified, the perforations shall conform to the requirements of Class 2, unless otherwise specified in the order. Class 1 perforations are for pipe intended to be used for subsurface drainage or combination storm and underdrain. Class 2 perforations are for pipe intended to be used for subsurface drainage only. The perforations shall be cleanly cut so as not to restrict the inflow of water. Pipe connected by couplings or bands may be unperforated within 100 mm of each end of each length of pipe.

7.3.1 Class 1 Perforations - Class 1 perforations shall be approximately circular, shall be a minimum of 5 mm and shall not exceed 10 mm in diameter, and shall be arranged in rows parallel to the axis of the pipe. The perforations shall be located in the external valleys with perforations in each row for each corrugation. The rows of perforations shall be arranged in two equal groups placed symmetrically on either side of the lower unperforated segment corresponding to the flow line of the pipe. The spacing of the rows shall be uniform. The distance between the center line of the rows shall not be less than 25 mm. There shall be at least 8 longitudinal

rows of perforations. A greater number of perforation rows, for increased inlet area, shall be subject to agreement between purchaser and manufacturer. The maximum height of the center lines of the uppermost rows of perforations above the bottom of the invert (H), as illustrated in Figure 1, shall be 0.46 times the pipe diameter. The inside chord lengths of the unperforated segments (L), as illustrated in Figure 1 shall be 0.64 times the pipe diameter.

Note 3 - The number of perforations in each row (and inlet area) is dependent on the corrugation pitch.

7.3.2 Class 2 Perforations - Circular perforations shall be a minimum of 5 mm and shall not exceed 10 mm in diameter. The width of slots shall not exceed 3 mm. The length of slots shall not exceed 75 mm. Perforations shall be placed in the external valleys and uniformly spaced along the length and circumference of the pipe. The water inlet area shall be a minimum of 40 cm²/m. All measurements shall be made in accordance with Section 9.7.3.

7.4 Pipe Stiffness - When tested in accordance with Section 9.1, at five percent deflection, 1350 mm diameter pipe shall have a minimum stiffness of 110 kPa 1500 mm diameter pipe shall have a minimum stiffness of 95 kPa.

7.5 Pipe Flattening - There shall be no evidence of wall buckling, cracking, splitting, or delamination, when the pipe is tested in accordance with Section 9.2.

7.6 Environmental Stress Cracking - There shall be no cracking of the pipe when tested in accordance with Section 9.4.

7.7 Brittleness - Pipe specimens shall not crack or split when tested in accordance with Section 9.3. Five non-failures out of six impacts are acceptable.

7.8 Fittings Requirements

7.8.1 Fittings shall not reduce or impair the overall integrity or function of the pipe line.

Note 4 - Common corrugated fittings include in-line joint fittings, such as couplings and reducers, and branch or complimentary assembly fittings such as tees, wyes, and end caps. These fittings are installed by various methods.