



Standard Specification for Deformed Polyethylene (PE) Liner¹

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1. Scope

1.1 This specification covers requirements and test methods for materials of deformed PE liner intended for the rehabilitation of gravity flow and nonpressure pipelines. This application is for municipal sewage, storm water, industrial process liquids and effluents, conduit, and ducts. This renewal process involves installing a deformed liner into an existing pipeline, conduit, or duct, then reforming the liner with heat and pressure to fit tightly to the bore of the original pipeline, conduit, or duct.

1.2 In referee decisions, inch-pound units shall be used. In all cases, the values given in parentheses are provided for information purposes only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:²

- D618 Practice for Conditioning Plastics for Testing
- D638 Test Method for Tensile Properties of Plastics
- D790 Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
- D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
- D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

F412 Terminology Relating to Plastic Piping Systems

F1248 Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe³

2.2 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁴

2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage⁵

3. Terminology

3.1 Definitions:

3.1.1 Unless otherwise indicated, definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600.

3.1.2 *deformed liner*—polyethylene pipe manufactured in a deformed shape that reduces the cross-sectional area for insertion and rehabilitation of nonpressure pipelines, conduits, and ducts. (See Fig. 1.)

3.1.3 *reformed liner*—a reformed pipe is a sample for test purposes formed when the deformed pipe has been inserted into a given casing pipe and rerounded with heat and pressure to fit snugly to the casing pipe taking a given cross-section, in accordance with Sections 5 and 6. (See Fig. 1.)

4. Materials

4.1 Material requirements are applicable only to materials prior to extrusion into the liner. Post-extrusion product requirements are presented in Section 6.

4.2 *Material Classifications*—Polyethylene materials allowable for use in the manufacture of polyethylene liner under this specification shall have a Plastic Pipe Institute (PPI)⁶ recommended Hydrostatic Design Basis in accordance with Table 1 and shall have a minimum classification in accordance with Specification D3350, as shown in Table 2.

4.3 *Rework Material*—Clean, rework material, meeting requirements in 4.2, and generated from the manufacturer's own

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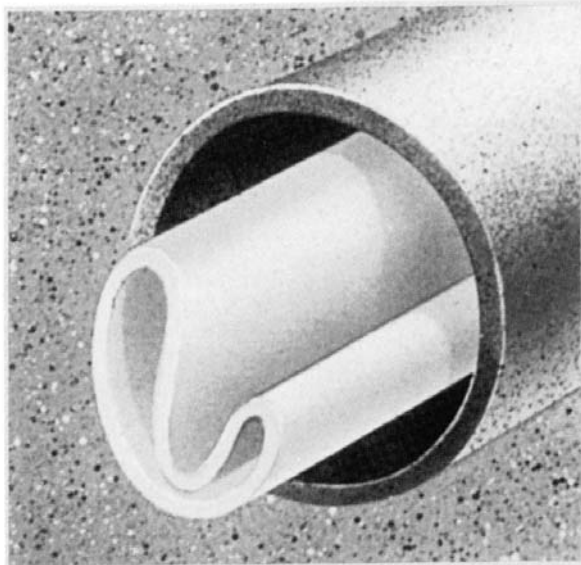
² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

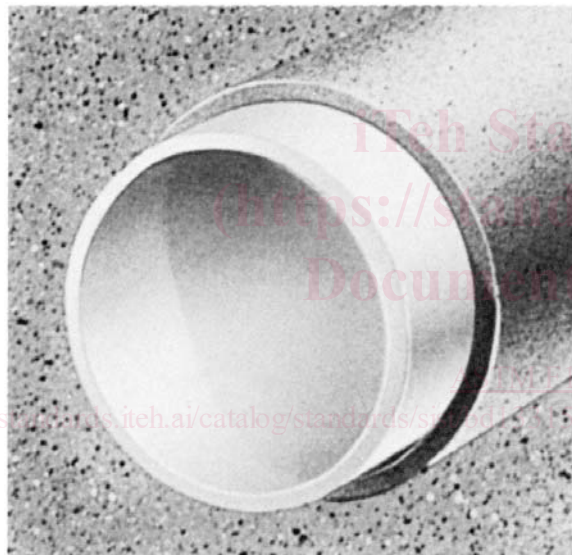
⁴ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

⁵ Available from the Superintendent of Documents, Washington, DC.

⁶ Plastics Pipe Institute, Division of the Society of the Plastics Industry, Inc., Wayne Interchange Plaza II, 155 Route 46 West, Wayne, NJ 07470.



(a) Deformed Pipe



(b) Reformed Pipe

NOTE 1—This figure is intended only for clarification of terms specific to this specification and shows representative deformed and reformed pipe shapes. Other deformed pipe shapes may meet the general requirements of this specification.

FIG. 1 Deformed Pipe and Reformed Pipe—Clarification of Terms

TABLE 1 Hydrostatic Design Basis of Pipe Materials

Thermoplastic Pipe Material Designation Code	Required Hydrostatic Design Basis
Pipe Designation	HDB, psi (MPa)
PE 3408	1600 psi at 73°F (11.03 MPa at 23°C)
PE 2406	1250 psi at 73°F (8.62 MPa at 23°C)

TABLE 2 Minimum D3350 Cell Classification Limits for Liner Materials^A

Property Material	PE 2406	PE 3408
Density	2	3
Melt	3	4
Flexural modulus	4	5
Tensile strength	3	4
ESCR	3	3
HDB	3	4
Color and UV stabilizer	C or E	C or E

^A Cell classification should be certified by the resin manufacturer per lot, as shipped to the pipe manufacturer.

long as the liner produced meets all of the requirements of this specification for the pipe designated.

5. Sampling

5.1 Reformed pipe sample preparation shall involve the rounding of a deformed pipe sample within a split pipe mold with an inside diameter equal to the nominal outside diameter shown in Table 3. A deformed pipe sample of sufficient length (10 ft maximum) to complete the testing requirements shall be inserted into the split pipe mold and secured at the ends. The ends shall have threaded nipples for applying steam with a pressure gage having steam discharge piping. The assembly shall be placed in an enclosed chamber for heating. Ambient pressure steam shall be applied to the chamber for at least a 15-min period at a minimum temperature of 200°F. The temperature shall be elevated to 250°F and the pipe shall be reformed by applying 14.5 psig for a period of 2 min. The pressure shall be increased to a maximum of 26 psig for an additional period of 2 min. While maintaining the 26-psig internal pressure, transition to air pressure and cool to 100°F or less. Remove the reformed sample from the mold for testing. Safety precautions shall be provided during the test procedure, that is, during application of steam and pressure.

5.2 A reformed pipe sample as returned from the job site using the job site reforming process shall be considered acceptable for testing purposes. Sample length shall be a minimum of 6 in. (153 mm).

5.3 The frequency of sampling shall be agreed upon between the purchaser and the seller.

TABLE 3 Dimensions and Tolerances

Nominal Outside Diameter, in. ^A	Outside Diameter Tolerances ^B	Minimum Wall Thickness, in.			
		DR17	DR24	DR26	DR32.5
3.00	+0.00, -0.015	0.176	0.124	0.115	...
4.00	+0.00, -0.015	0.234	0.166	0.153	...
6.00	+0.00, -0.015	0.352	0.249	0.230	0.184
8.00	+0.00, -0.020	0.469	0.332	0.306	0.245
10.00	+0.00, -0.020	0.587	0.416	0.384	0.307
12.00	+0.00, -0.025	0.704	0.499	0.461	0.368
15.00	+0.00, -0.050	0.879	0.623	0.575	0.460
18.00	+0.00, -0.060	1.055	0.748	0.690	0.552

^A The reformed pipe permits variance of nominal outside diameter during installation of -0.4 to +3.4 % to match existing pipe inside diameter. The larger variance may increase the DR value. Existing inside pipe diameters outside this range will necessitate special sizes.

^B The listed outside diameter tolerances are provided for manufactured liner pipe.

pipe production, may be used by the same manufacturer, with material meeting requirements in 4.2 in any combination, as