



Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage¹

This standard is issued under the fixed designation F 2562/F 2562M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers requirements and test methods for materials, dimensions, workmanship, impact resistance, pipe stiffness, flattening, buckling, tensile strength of seam, joint systems, perforations, and markings for steel reinforced thermoplastic pipe and fittings of nominal sizes 8 in. [200 mm] through 120 in. [3000 mm]. The steel reinforced, spirally formed thermoplastic pipes governed by this standard are intended for use in underground applications where soil provides support for their flexible walls. These pipes will be used for gravity flow and non-pressure applications, such as storm sewers, sanitary sewers, industrial waste applications and drainage pipes.

1.2 *Units*—The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text the SI units are shown in brackets. The values stated in each system may not be exact equivalents: therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

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.*

1.4 There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 *ASTM Standards:*²

A 1008/A 1008M Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

A 1011/A 1011M Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength

D 618 Practice for Conditioning Plastics for Testing

D 638 Test Method for Tensile Properties of Plastics F2562/F2562M-08

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D 2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D 2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

D 2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D 3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

D 3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

F 412 Terminology Relating to Plastic Piping Systems F449 Practice for Subsurface Installation of Corrugated Polyethylene Pipe for Agricultural Drainage or Water Table Control

F 477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F 2136 Test Method for Notched, Constant Ligament-Stress (NCLS) Test to Determine Slow-Crack-Growth Resistance of HDPE Resins or HDPE Corrugated Pipe

2.2 *American Association of State Highway and Transportation Officials (AASHTO)*³

AASHTO LRFD Bridge Construction Specification Section 26

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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 Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, <http://www.transportation.org>.

AASHTO M294-05 Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter

2.3 *Federal Standards:*⁴

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

2.4 *Military Standards:*

MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 Definitions—Definitions used in this specification are in accordance with Terminology F 412, unless otherwise noted.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *gravity flow, n*—a condition where liquid flow through a piping system results from a downward pipeline slope, but flow is less than full, except during conditions when the system may become temporarily surcharged in which case, the system is subject to temporary internal hydrostatic pressure that is limited to piping system joint capabilities.

3.2.2 *steel reinforced thermoplastic pipe, n*—ribbed thermoplastic pipe with steel reinforcing strips encapsulated within the ribs (See Fig. 1).

3.2.3 *encapsulation thicknesses, n*—the thicknesses of the HDPE covering on both sides of the steel reinforcement as well as the thickness of the closure at the top (outside) of the rib and the thickness of the profile directly under (inside) of the reinforcement.

3.2.4 *wrap width, n*—the width the helically wrapped strip covers when measured across the strip, perpendicular to the ribs (See Fig. 1).

4. Significance and Use

4.1 Steel reinforced thermoplastic pipes are used for underground applications where soil provides support to their flexible walls. Their main use is for gravity flow and non-pressure drainage of surface water, sanitary sewage and industrial waste.

NOTE 1—Industrial waste disposal lines should be installed only upon the specific approval of the governing code, or other authority, and after determining the suitability of the product under the anticipated environment, temperature, and other end-use conditions. Users should consult the manufacturer for the required product information.

4.2 This specification covers pipe products made in various stiffness classes according to Table 1 at 5 % deflection when tested in accordance with Test Method D 2412. The required stiffness class shall be determined by structural design calculations based on the application of the pipe.

4.3 This specification covers pipe products using the following different joining systems;

4.3.1 *Bell and spigot, gasketed type* —seal is affected by a gasket compressed between the spigot and bell ends of the pipe.

4.3.2 *Internal coupling, sealant type*—seal is affected by applying an industrial sealant between the external surface of the coupling and the internal surface of the pipe.

4.3.3 *Other*—Where these connections are impractical or undesirable because of space, layout or other requirements, it is permissible to use joining methods such as flanging, internal coupling (gasketed type), extrusion welding, electro-fusion, butt fusion, and others. Methods proposed should be evaluated by the engineer for suitability.

5. Materials

5.1 *Polyethylene Materials:*

5.1.1 Polyethylene materials used in the manufacture of steel reinforced thermoplastic pipe shall meet or exceed the requirements of cell classification of 335420C or E (335430C or E for sanitary sewer applications) as defined and described in Specification D 3350.

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

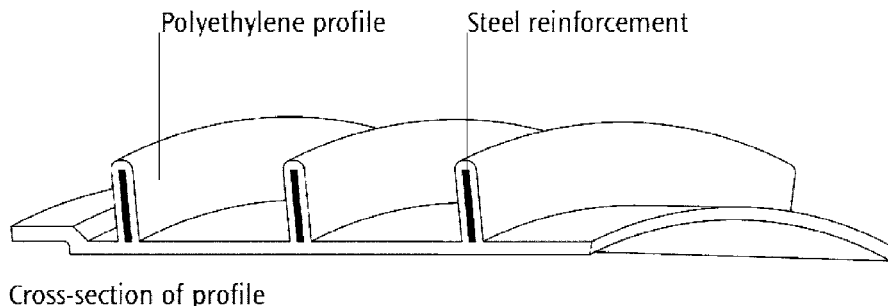


FIG. 1 Steel Reinforced Thermoplastic Ribbed Pipe Profile

TABLE 1 Pipe Stiffness Classes and Buckling Limits

Nominal Pipe Size	Inside Diameter	Class 1		Class 2		Class 3		Class 4		Class 5	
		Pipe stiffness psi [kPa]	Buckling Limit %	Pipe stiffness psi [kPa]	Buckling Limit %	Pipe stiffness psi [kPa]	Buckling Limit %	Pipe stiffness psi [kPa]	Buckling Limit %	Pipe stiffness psi [kPa]	Buckling Limit %
8	8 [200]	50 [345]	20	16 [110]	20	32 [221]	20	46 [317]	20	63 [434]	20
9	9 [225]	50 [345]	20	16 [110]	20	32 [221]	20	46 [317]	20	63 [434]	20
10	10 [250]	50 [345]	20	16 [110]	20	32 [221]	20	46 [317]	20	63 [434]	20
12	12 [300]	50 [345]	20	16 [110]	20	32 [221]	20	46 [317]	20	63 [434]	20
15	15 [375]	42 [290]	20	16 [110]	20	32 [221]	20	46 [317]	20	63 [434]	15
18	18 [450]	40 [275]	20	16 [110]	20	32 [221]	20	46 [317]	20	63 [434]	15
21	21 [525]	38 [260]	20	16 [110]	20	32 [221]	20	46 [317]	15	63 [434]	10
24	24 [600]	34 [235]	20	16 [110]	20	32 [221]	20	46 [317]	15	63 [434]	10
27	27 [675]	30 [205]	20	16 [110]	20	32 [221]	20	46 [317]	12	--	--
30	30 [750]	28 [195]	20	16 [110]	20	32 [221]	20	46 [317]	12	--	--
33	33 [825]	25 [170]	20	16 [110]	20	32 [221]	15	46 [317]	10	--	--
36	36 [900]	22 [150]	20	16 [110]	20	32 [221]	15	46 [317]	10	--	--
40	40 [1000]	20 [140]	20	16 [110]	20	32 [221]	10	46 [317]	10	--	--
42	42 [1050]	20 [140]	20	16 [110]	20	32 [221]	10	46 [317]	10	--	--
48	48 [1200]	18 [125]	15	16 [110]	15	32 [221]	10	46 [317]	10	--	--
54	54 [1350]	16 [110]	15	16 [110]	15	32 [221]	10	46 [317]	10	--	--
60	60 [1500]	14 [97]	15	16 [110]	15	32 [221]	10	46 [317]	10	--	--
66	66 [1650]	14 [97]	12	16 [110]	12	32 [221]	10	46 [317]	10	--	--
72	72 [1800]	14 [97]	12	16 [110]	12	32 [221]	10	46 [317]	10	--	--
78	78 [1950]	14 [97]	10	16 [110]	10	32 [221]	10	--	--	--	--
90	90 [2250]	14 [97]	10	16 [110]	10	32 [221]	10	--	--	--	--
96	96 [2400]	--	--	16 [110]	10	--	--	--	--	--	--
100	100 [2500]	--	--	16 [110]	10	--	--	--	--	--	--
108	108 [2700]	--	--	16 [110]	10	--	--	--	--	--	--
120	120 [3000]	--	--	16 [110]	10	--	--	--	--	--	--

5.1.2 Polyethylene materials used in the manufacture of rotationally molded joints, fittings and couplings shall meet or exceed the requirements of cell classification 213320C or E (213330C or E for sanitary sewer applications) as defined and described in Specification D 3350.

5.1.3 Polyethylene materials used in the manufacture of injection molded joints, fittings and couplings shall meet or exceed the requirements of cell classification 314420C or E (314430C or E for sanitary sewer applications) as defined and described in Specification D 3350.

5.1.4 Slow crack growth resistance of the polyethylene materials shall be determined by testing in accordance with Test Method F 2136. The applied stress shall be 600 psi [4100 kPa]. The test specimens shall exceed 24 h with no failures. Testing shall be done on polyethylene material taken from the finished pipe, joint, fitting or coupling.

5.1.5 *Other pipe materials*—It is permissible to use materials other than those specified under base materials as part of the profile construction, for example to weld the spiral seam together or the welding of couplings, provided that these materials are compatible with the base material, and in no way compromise the performance of the pipe products in the intended use.

5.1.6 *Carbon Black Content*—The carbon black content shall be a maximum of 3.0 wt. % of the total of the polyethylene compound.

5.1.7 *Rework Material*— It is permissible to use clean rework polyethylene material generated from the manufacturer's own pipe production provided the material and the pipe produced meet all the requirements of this specification.

5.2 *Steel Materials*— The steel material shall be uncoated cold or hot rolled, formable steel meeting the requirements of either Specification A 1008/ A 1008M or Specification A 1011/A 1010M, with a minimum yield strength of 20,305 psi [140 MPa]. In special circumstances it is permissible for galvanized, coated or stainless steel materials to be used.

5.3 *Gaskets*—Elastomeric gaskets shall comply with the requirements specified in Specification F 477, and be as recommended by the pipe manufacturer.

5.4 *Lubricant*—The lubricant used for assembly of gasketed joints shall be as recommended by the pipe manufacturer and have no detrimental effect on the gasket or on the pipe.

5.5 *Industrial sealant*—Sealants, such as moisture cure urethane materials used for repairs or assembly of the internal coupling joint shall be as recommended by the pipe manufacturer and have no detrimental effect on the pipe materials.

6. Requirements

6.1 *Workmanship*— The inside and outside surfaces of the pipe shall be semi-matte or glossy in appearance and free of chalking, sticky, or tacky materials. The pipe wall shall not have cracks, holes, blisters, voids, foreign inclusions, or other defects that are visible to the naked eye and that can affect the wall integrity or the encapsulation of the steel reinforcement. Holes deliberately placed in perforated pipe are permitted. The steel reinforcing materials shall not be exposed.

6.2 Pipe Dimensions and Tolerances :

6.2.1 Various different types of steel reinforced ribbed polyethylene pipes are available depending on the diameter and the stiffness class of pipe. The profile shown in Fig. 2 is an example of a typical profile only. The pipe profile shall be suitably designed

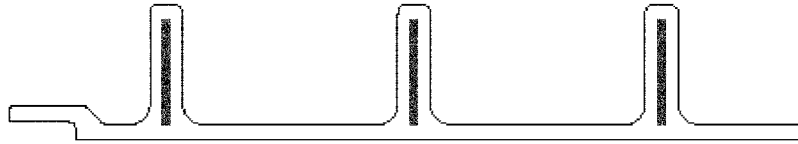


FIG. 2 Typical Profile of Steel Reinforced Thermoplastic Pipe Profile

and the actual materials used shall be specified so as to accommodate expected in-service conditions, including temporary system surcharge pressures, soil loads and external hydrostatic pressures due to groundwater conditions. It is permissible for the shape and number of ribs of individual extrusion profiles to be varied.

6.2.2 Pipe Dimensions (for both perforated and non-perforated pipe) shall comply with Table 2, when measured in accordance with Test Method D 2122. Other diameters that are within the range of pipe sizes shown in Table 2 are permissible. The minimum wall thickness and other properties shall be interpolated from the adjacent values given in the table below. Fig. 3 is provided as a schematic representation of the steel reinforced thermoplastic pipe profile.

6.2.3 *Inside Diameter*— The tolerance on the inside diameter shall be $\pm 1.0\%$, when measured in accordance with section 8.3.1.

6.2.4 *Pipe waterway wall*—Minimum waterway wall thickness shall be as required in Table 2 when measured in accordance with 8.3.2.

NOTE 2—Enhanced waterway wall thicknesses may be provided for applications where the pipe is to convey slurry or other suspension of particularly abrasive particles.

6.2.5 *Length*—The pipe shall be sold in any length agreeable to the user. Length shall not be less than 99 % of the specified length, when measured in accordance with section 8.3.3.

6.2.6 *Encapsulation thickness*,—The minimum thickness of the HDPE encapsulation at the sides, top (outside) and bottom (inside) of the reinforcement shall be as shown in Fig. 3. Factory cut pipe ends shall have the cut rib ends encapsulated to meet the requirements of Fig. 3 for the top (outside) of the ribs. Encapsulation thicknesses shall be measured in accordance with 8.3.4.

6.2.7 *Perforations*

6.2.7.1 *Drainage Pipe*— When perforations are necessary they shall be cleanly cut and uniformly spaced along the length and circumference of the pipe in a size, shape and pattern suited to the needs of the user. Perforations shall be located in the waterway wall portion of the pipe between the ribs and of a size and position to not encroach on the encapsulation of the reinforcement, the radius between this encapsulation and the waterway wall, or the weld seam. The reinforcing steel material shall not be exposed by these perforations.

TABLE 2 Nominal Pipe Sizes, Inside Diameters, and Minimum Waterway Wall Thicknesses

Nominal Pipe Size	Inside Diameter	Minimum Waterway Wall Thickness, t_1	Minimum Encapsulation Thickness (Bottom), t_2
in.	in. [mm]	in. [mm]	in. [mm]
8	8 [200]	0.039 [1.0]	0.024 [0.6]
9	9 [225]	0.039 [1.0]	0.024 [0.6]
10	10 [250]	0.039 [1.0]	0.028 [0.7]
12	12 [300]	0.043 [1.1]	0.035 [0.9]
15	15 [375]	0.047 [1.2]	0.039 [1.0]
18	18 [450]	0.051 [1.3]	0.051 [1.3]
21	21 [525]	0.059 [1.5]	0.059 [1.5]
24	24 [600]	0.059 [1.5]	0.059 [1.5]
27	27 [675]	0.059 [1.5]	0.059 [1.5]
30	30 [750]	0.059 [1.5]	0.059 [1.5]
33	33 [825]	0.059 [1.5]	0.059 [1.5]
36	36 [900]	0.067 [1.7]	0.067 [1.7]
40	40 [1000]	0.071 [1.8]	0.071 [1.8]
42	42 [1050]	0.071 [1.8]	0.071 [1.8]
48	48 [1200]	0.071 [1.8]	0.071 [1.8]
54	54 [1350]	0.079 [2.0]	0.079 [2.0]
60	60 [1500]	0.079 [2.0]	0.079 [2.0]
66	66 [1650]	0.087 [2.2]	0.087 [2.2]
72	72 [1800]	0.087 [2.2]	0.087 [2.2]
78	78 [1950]	0.094 [2.4]	0.094 [2.4]
90	90 [2250]	0.094 [2.4]	0.094 [2.4]
96	96 [2400]	0.118 [3.0]	0.118 [3.0]
100	100 [2500]	0.118 [3.0]	0.118 [3.0]
108	108 [2700]	0.118 [3.0]	0.118 [3.0]
120	120 [3000]	0.118 [3.0]	0.118 [3.0]