Designation: ~~F2562/F2562M – 15 (Reapproved 2019)~~ F2562/F2562M – 24

Specification for Steel Reinforced Thermoplastic Ribbed Pipe and Fittings for Non-Pressure Drainage and Sewerage[1]

This standard is issued under the fixed designation F2562/F2562M; 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~~ 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 There is no similar or equivalent ISO standard.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A1008/A1008M Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable

A1011/A1011M 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

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer.

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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.

***A Summary of Changes section appears at the end of this standard**

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
D2444 Practice for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)
D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials
F412 Terminology Relating to Plastic Piping Systems
F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F2136 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
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 F412, 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.

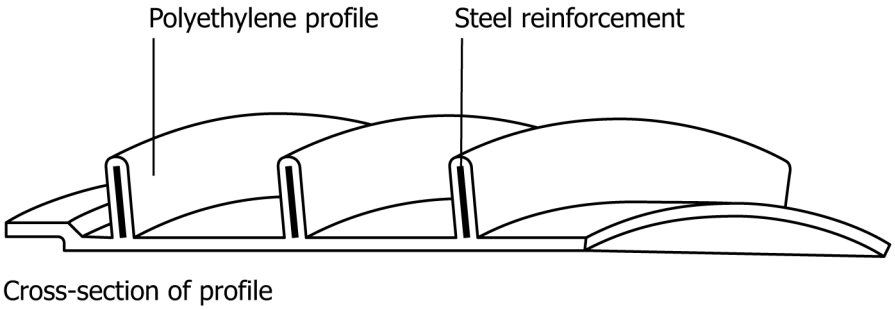

FIG. 1 Steel Reinforced Thermoplastic Ribbed Pipe Profile

[3] Available from American Association of State Highway and Transportation Officials (AASHTO), ~~444 N. Capitol~~ 555 12th St., NW, Suite ~~249,~~1000, Washington, DC ~~20001,~~20004, http://www.transportation.org.

[4] DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 http://quicksearch.dla.mil/

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 D2412. 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 D3350.

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 D3350.

TABLE 1 Pipe Stiffness Classes and Buckling Limits

		Class 1		Class 2		Class 3		Class 4		Class 5	
Nominal Pipe Size in.	Inside Diameter in. [mm]	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	--	--	--	--	--	--

5.1.3 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 D3350.

5.1.4 Slow crack growth resistance of the polyethylene materials shall be determined by testing in accordance with Test Method F2136. 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*—For compounds utilizing carbon black, 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 coated or uncoated cold or hot rolled, formable ~~steel meeting~~ steel. Uncoated steel shall meet the requirements of either Specification A1008/A1008M or Specification A1011/A1011M. Coated steel shall meet the requirements of A653/A653M and the mechanical requirements for strength in Table 4 of A653/A653M for the grade defined by the manufacturer as required for their pipe's design. All galvanized steel materials shall meet the requirements of A653/A653M with a G60 minimum coating weight. In special circumstances it is permissible for ~~galvanized, coated or stainless~~ other steel materials to be used. All steel materials must have a minimum yield strength of 20 305 psi [140 MPa].

NOTE 2—The actual strength of the steel and the rib dimensions are dependent on the manufacturer's design. If requested by the purchaser, the manufacturer shall provide before purchase and delivery their pipe design and certify with delivery that the grade of steel and rib dimensions in the pipe supplied conform to their design.

5.3 *Gaskets*—Elastomeric gaskets shall comply with the requirements specified in Specification F477, 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 have a maximum burr tolerance of 5 % of the ~~guage~~gauge thickness, shall be free of tears, and 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 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 D2122. Other diameters that are within the range of pipe sizes shown in Table 2 are permissible. The minimum

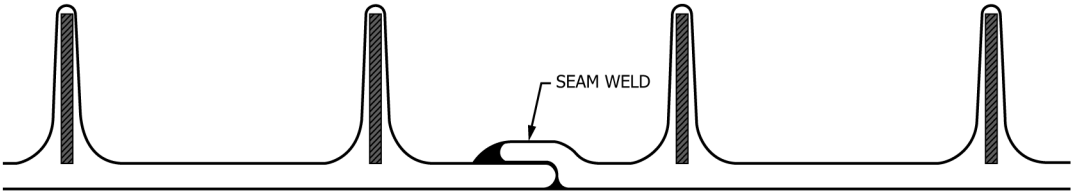

FIG. 2 Typical Profile of Steel Reinforced Thermoplastic Pipe Profile

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]	0.039 [1.0]
9	9 [225]	0.039 [1.0]	0.039 [1.0]
10	10 [250]	0.039 [1.0]	0.039 [1.0]
12	12 [300]	0.043 [1.1]	0.043 [1.1]
15	15 [375]	0.047 [1.2]	0.047 [1.2]
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]

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 ± 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.

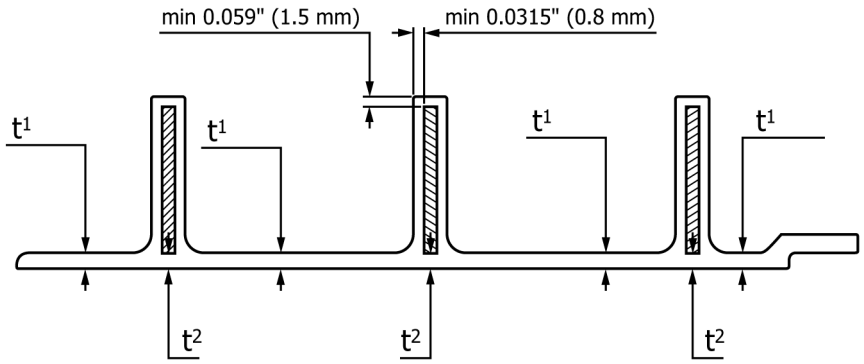

FIG. 3 Schematic Representation of Steel Reinforced Thermoplastic Pipe Profile

NOTE 3—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. 2 and 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. The perforations shall be circular, oval or rectangular with rounded corners. 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.

6.2.7.2 The total inlet area of the perforations shall be a minimum of 1 square inch per linear foot [2,100 mm^2/m] of pipe, unless otherwise specified by the purchaser.

6.3 *Pipe Stiffness*— The stiffness of the pipe measured at 5 % deflection shall be one of the classes listed in Table 1 (unless otherwise specified), when tested in accordance with section 8.4.

NOTE 4—The 5 % deflection criteria was selected for testing convenience and should not be considered as a limitation with respect to in-use deflection.

NOTE 5—Stiffness and buckling limit requirements for Class 1 in Table 1 are equivalent to those specified in AASHTO M294-05.

6.4 *Flattening*—There shall be no evidence of splitting, cracking or breaking, when tested in accordance with section 8.5. Additionally there shall be no separation or de-lamination of the spiral seam or the rib at the top of its junction with the waterway wall of the pipe when tested in accordance with section 8.5.

6.5 *Buckling*—In the flattening test described in section 6.4, the load shall increase continuously with increasing deflection until after the percentage buckling deflection limit tabulated for the relevant diameter and stiffness class (in Table 1) has been exceeded. In addition, where peak load is reached before 20 % deflection, the load at 20 % deflection shall be a minimum of 75 % of the peak load.

6.6 *Impact*—there shall be no evidence of splitting, cracking or breaking when tested in accordance with section 8.6. Additionally there shall be no separation of the seam weld or the rib at the top of its junction with the waterway wall when tested in accordance with section 8.6.

6.7 *Tensile strength of seam weld*—there shall be no breaking or separation of the seam weld when tested in accordance with section 8.7.

6.8 *Fittings and Couplings*—Only fittings and couplings supplied or recommended by the manufacturer shall be used. Fabricated fittings and couplings shall be supplied with joints compatible with the overall system requirements. Bell and spigot joints are examples of typical designs.

6.9 *Joint tightness*— the joint shall be defined as one of the following classes. Only watertight joints (6.9.3) shall be used for sanitary sewer and industrial waste applications.

6.9.1 Soil tight joints are specified as a function of opening size, channel length and backfill particle size. If the size of the opening exceeds 3 mm, the length of the channel shall be at least four times the size of the opening. A backfill material containing a high percentage of fine graded soils requires investigation for the specific type of joint to be used to guard against soil infiltration. Information regarding joint soil tightness criteria can be found in AASHTO LRFD Bridge Construction Specification Section 26.