



Designation: F3219 – 18

Standard Specification for 3 to 30 in. (75 To 750 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Fittings¹

This standard is issued under the fixed designation F3219; 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, elongation, brittleness, pipe stiffness, and markings for single wall corrugated polypropylene (PP) pipe and fittings. It covers nominal sizes 3 in. through 30 in. (75 mm through 750 mm)

1.2 The corrugated polypropylene pipe and fittings are for use in non-pressure gravity applications, including leach field effluent disposal, and drainage applications such as land, roads, foundations, agricultural, and landfill.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *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.*

1.5 *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

D256 Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

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

D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

D1238 Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer

D1505 Test Method for Density of Plastics by the Density-Gradient Technique

D1600 Terminology for Abbreviated Terms Relating to Plastics

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)

D3895 Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry

D4101 Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials

F412 Terminology Relating to Plastic Piping Systems

F449 Practice for Subsurface Installation of Corrugated Polyethylene Pipe for Agricultural Drainage or Water Table Control

F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

2.2 *AASHTO Standard:*³

AASHTO LRFD Bridge Design Specifications

3. Terminology

3.1 Definitions are in accordance with Terminology **F412** and abbreviations are accordance with Terminology **D1600**, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.65 on Land Drainage.

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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.

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

3.2.1 *single wall pipe, n*—corrugated pipe without an interior or exterior liner.

3.2.2 *lot size, n*—the total number of completely finished fittings or appurtenances that are manufactured under conditions of production that are considered uniform.

4. Significance and Use

4.1 Single wall corrugated PP pipe and fittings are intended for underground applications where soil provides support to their flexible walls. Their major use is to collect or convey drainage water, or both.

4.2 Single wall corrugated PP pipe shall have perforations where groundwater control or replenishing is specified.

4.3 Single wall corrugated PP pipe shall not be used for storm sewer or sanitary sewer applications.

5. Materials

5.1 *Polypropylene*—Polypropylene compounds used in the manufacture of corrugated single wall pipe shall have the minimum properties as shown in Table 1. Polypropylene compounds shall be comprised of the base polypropylene virgin material and all additives, colorants, UV inhibitors, and stabilizers. Polypropylene compounds can be pre-compounded or made in-situ during pipe extrusion by combining natural polypropylene material with a color masterbatch or other additives, or both. Conditioning, sampling, preparation and testing of molded specimens shall be in accordance with the requirements in Specification D4101. Material for preparation of molded specimens shall be taken from the pipe. Compounds that have a higher cell classification in one or more performance properties shall be permitted provided the density of the base resin shall not exceed 0.0343 lb/in.³ (0.950 g/cm³) and all other product requirements are met.

5.2 *Color and Ultraviolet (UV) Stabilization*—The pipe shall be colored or black. Black polypropylene compounds shall have between 2.0 and 3.0 percent carbon black. Colored polypropylene compounds shall be protected from Ultraviolet (UV) degradation with UV stabilizers. Colored polypropylene compounds shall contain sufficient UV protection to allow pipe made according to this standard to be stored outdoors for at least two years from the date of manufacture without degradation of the stated properties.

5.3 *Rework Material*—Clean polypropylene rework material, generated from the manufacturer’s own production of the product and having the same minimum physical properties, may be used by the manufacturer, provided that the pipe produced meets all the requirements of this specification.

TABLE 1 Polypropylene Compound Properties

Property	ASTM Test Method	Units (SI Units)	Minimum Value
Melt Flow Rate (at 446°F (230°C))	D1238	g/10 min	0.15
Density	D792, D1505	lb/in ³ (g/cm ³)	0.0325 (0.900)
Tensile Strength at Yield	D638	psi (N/mm ²)	3500 (24.1)
Elongation at Yield	D638	% (%)	5 (5)
Flexural Modulus (1% secant)	D790	psi (N/mm ²)	175,000 (1200)
IZOD Impact Strength (73°F(23°C))	D256	ft-lb/in (J/m)	8 (427)
Oxidative-Induction Time (392°F (200°C))	D3895	min	25

5.4 *Rubber Materials*—Rubber compounds used in the manufacture of sealing rings or gaskets shall meet the requirements of Specification F477.

5.5 *Lubricant*—The lubricant used for assembly of gasketed joints shall have no detrimental effect on the gasket or on the pipe

6. Joining and Joint Systems

6.1 *Bell and Spigot Joint:*

6.1.1 The pipe ends shall consist of integrally formed bell and spigot designed to accommodate a gasket, which when assembled forms a soiltight seal by the radial compression of the gasket between the spigot and the bell ends.

6.1.2 The joint shall be designed to avoid displacement of the gasket when it is assembled in accordance with the manufacturer’s recommendations.

6.1.3 The assembly of the joint shall be in accordance with the manufacturer’s recommendations.

6.2 *Other Joining Systems*—Joining methods such as external snap couplers, split couplers, or other joining processes that are equally effective are to be used in accordance with the manufacturer’s recommendations.

7. Requirements

7.1 *Workmanship*—The pipe and fittings shall be homogeneous throughout and be as uniform as commercially practical in color, opacity, and density. The pipe wall shall be free of cracks, holes, blisters, voids, foreign inclusions or other defects that are visible to the naked eye and that may affect the wall integrity. The ends shall be cut cleanly and squarely.

7.2 *Pipe Dimensions:*

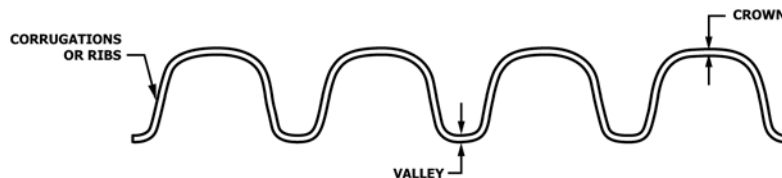


FIG. 1 Typical Annular Corrugated Profile Wall Polypropylene

7.2.1 *Nominal Size*—The nominal size for pipe and fittings shall be as shown in **Table 2** and are based on the inside diameter of the pipe.

7.2.2 *Inside Diameter*—Measure the inside diameter in accordance with Test Method **D2122**. The tolerances are shown in **Table 2**, when measured in accordance with **9.3**, and shall be applied to the stated manufacturer’s supplied diameter. In no case shall the manufacturer’s stated inside diameter minus the tolerance be less than the required minimum pipe inside diameter listed in **Table 2**.

7.2.3 *Pipe Dimensions* shall comply with **Table 2**, when measured in accordance with Test Method **D2122**.

7.2.4 *Laying Length*—The pipe may be sold in any laying length agreeable to the user. Laying length shall not be less than 99% of the stated quantity, when measured in accordance with **9.4** at 73°F + 3.6°F (23°C + 2°C).

7.2.5 *Pipe Stiffness*—The pipe shall have a minimum pipe stiffness of 46 psi (320 KPa) at 5% deflection, when tested in accordance with **9.5**.

7.2.6 *Impact*—Pipe specimens shall be tested in accordance with **9.6**. The test specimens, when examined under normal light and the unaided eye, shall show no splitting or cracking. The minimum pipe impact strength at 73°F (23°C) shall be 140 ft-lbf (189 J).

7.2.7 *Flattening*—There shall be no evidence of splitting, cracking or breaking when pipe is tested in accordance with **9.5**.

7.3 *Fittings and Joining System Requirements:*

7.3.1 The fittings shall not reduce or impair the overall integrity or function of the pipeline. Only fittings made to this specification and couplers supplied or recommended by the pipe manufacturer shall be used. Fittings fabricated from pipe manufactured according to this standard shall meet the same material requirements as the pipe. The outside diameters and the corrugation pitch of products manufactured to this specifi-

cation are not specified; thus, compatibility between pipe and fittings made to this specification by different manufacturers shall be verified to meet the requirements of **7.2.1** and **7.2**.

NOTE 1—Fittings may be fabricated from the pipe by a variety of processes including hot plate welding, spin welding or other processes.

7.3.2 *Fittings:*

7.3.2.1 The maximum allowable gap between pipe and fitting shall not exceed 1/8 in. [3 mm] unless otherwise specified.

7.4 *Perforations:*

7.4.1 *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 in the valley of the corrugation and located, sized and spaced to minimize the structural impact on the pipe wall.

7.4.2 The inlet area of the perforations shall be a minimum of 1 in.² /ft [21 cm² /m] of pipe, unless otherwise specified by the user.

7.5 *Installation Requirements*—The pipe manufacturer shall provide the purchaser with the requirements for the proper installation of the pipe and the minimum and maximum cover height for specific traffic and non-traffic loading conditions. The installation requirements shall be based on Practice **F449** or **D2321** and manufacturer’s guidelines.

8. Sampling and Retest

8.1 *Sampling*—Samples of pipe and fittings sufficient to determine conformance with this specification shall be taken at random by the testing agency. Where a test report is requested for a customer order, the samples shall be taken from the production lot (as indicated by the manufacturer’s production code) representing the product to be shipped on the order.

8.2 *Retest and Rejection*—Retesting in the event of a test failure shall be conducted on samples from the failed lot only under an agreement between purchaser and seller. There shall be no changes to the test procedures or the requirements.

9. Test Methods

9.1 *Conditioning Test Specimens*—Condition the specimen prior to test at 73.4 + 3.60 °F (23 + 20 °C) and 50 + 5 % relative humidity for not less than 24 h prior to the test, in accordance with Procedure A in Practice **D618** for those tests where conditioning is required, unless otherwise specified.

9.2 *Test Conditions*—Conduct tests in a laboratory atmosphere of 73.4 + 3.6 °F (23 + 20 °C) and 50 + 5 % relative humidity, unless otherwise specified.

9.3 *Inside Diameter*—Measure the inside diameter of three 1-ft long (300-mm) specimens, with any suitable device accurate to 0.001 in (0.02 mm), at positions at the seam and 90° from the seam.

9.4 *Length*—Measure the pipe with any suitable device accurate to +1/32 in. (0.8 mm) in 10 ft. (1 mm in 3 m). Make all measurements on the pipe while it is resting on a flat surface at ambient temperature, in a straight line, with no external tensile or compressive forces exerted on the pipe.

TABLE 2 Nominal Pipe Sizes, Inside Diameters and Tolerances for Single Wall Corrugated Polypropylene Pipes

Nominal Pipe Size	Minimum Inside Diameter, in. (mm)	Inside Diameter Tolerances, in. (mm)
3	2.90 (74)	±0.040 (±1.02)
4	3.88 (99)	±0.040 (±1.02)
6	5.61 (142)	±0.040 (±1.02)
7	6.93 (176)	±0.045 (±1.14)
8	7.70 (196)	±0.045 (±1.14)
9	8.65 (220)	±0.055 (±1.40)
10	9.70 (246)	±0.055 (±1.40)
11	10.87 (276)	±0.075 (±1.91)
12	11.90 (302)	±0.100 (±2.54)
14	13.68 (347)	±0.100 (±2.54)
15	14.85 (377)	±0.150 (±3.81)
17	16.95 (431)	± 0.125 (±3.18)
18	17.93 (455)	±0.170 (±4.32)
21	20.75 (527)	±0.170 (±4.32)
22	21.48 (546)	±0.170 (±4.32)
24	23.90 (607)	±0.227 (± 5.77)
30	29.79 (757)	±0.240 (± 6.1)

NOTE—The manufacturer’s stated inside diameter is the nominal diameter plus or minus the inside diameter tolerance. The minimum inside diameter is the smallest diameter the pipe can be with these tolerances and is used for the hydraulic design of the pipe.