



Designation: D6783 – 05a (Reapproved 2022)

Standard Specification for Polymer Concrete Pipe¹

This standard is issued under the fixed designation D6783; 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 polymer concrete pipe, 6 in. (150 mm) through 144 in. (3 660 mm), intended for use in gravity-flow systems for conveying sanitary sewage, storm water, and industrial wastes.

1.2 Although this specification is suited primarily for pipe to be installed by direct burial and pipe jacking, it may be used to the extent applicable for other installations such as sliplining and rehabilitation of existing pipelines.

NOTE 1—Unlike reinforced thermosetting resin pipes, polymer concrete pipe is designed and installed using rigid pipe design theory and practices.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 8, of this specification. *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.*

NOTE 2—There is no known ISO equivalent to this 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

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.23 on Reinforced Thermosetting Resin Piping Systems and Chemical Equipment.

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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.

[A276/A276M Specification for Stainless Steel Bars and Shapes](#)

[C33/C33M Specification for Concrete Aggregates](#)

[C117 Test Method for Materials Finer than 75- \$\mu\$ m \(No. 200\) Sieve in Mineral Aggregates by Washing](#)

[C125 Terminology Relating to Concrete and Concrete Aggregates](#)

[C136/C136M Test Method for Sieve Analysis of Fine and Coarse Aggregates](#)

[C579 Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes](#)

[D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position](#)

[D883 Terminology Relating to Plastics](#)

[D1600 Terminology for Abbreviated Terms Relating to Plastics](#)

[D2584 Test Method for Ignition Loss of Cured Reinforced Resins](#)

[D3567 Practice for Determining Dimensions of “Fiberglass” \(Glass-Fiber-Reinforced Thermosetting Resin\) Pipe and Fittings](#)

[D3681 Test Method for Chemical Resistance of “Fiberglass” \(Glass-Fiber-Reinforced Thermosetting-Resin\) Pipe in a Deflected Condition](#)

[D3892 Practice for Packaging/Packing of Plastics](#)

[D4161 Specification for “Fiberglass” \(Glass-Fiber-Reinforced Thermosetting-Resin\) Pipe Joints Using Flexible Elastomeric Seals](#)

[F412 Terminology Relating to Plastic Piping Systems](#)

[F477 Specification for Elastomeric Seals \(Gaskets\) for Joining Plastic Pipe](#)

3. Terminology

3.1 *Definitions*—Unless otherwise indicated, definitions are in accordance with Terminologies C125, D883, and F412, and abbreviations are in accordance with Terminology D1600.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aggregate, n*—a granular material, such as sand, gravel, or crushed stone, in accordance with to the requirements of Specification C33/C33M except that the requirements for gradation shall not apply.

3.2.2 *pipe jacking, n*—a system of directly installing pipes behind a shield machine by hydraulic jacking from a drive shaft, such that the pipes form a continuous string in the ground.

3.2.3 *polymer concrete, n*—a composite material that consists essentially of a thermosetting resin within which are embedded particles or fragments of aggregate.

3.2.4 *polymer concrete pipe, n*—tubular product containing aggregate, embedded in or surrounded by cured thermosetting resin, which may also contain granular or platelet fillers, thixotropic agents, pigments, or dyes.

3.2.5 *qualification test, n*—one or more tests used to prove the design of a product and which are not routine quality control tests.

4. Classification

4.1 Polymer concrete pipe furnished under this specification is manufactured in strength classes I, II, III, IV, or V as given in Table 1. (See also Note 5.)

NOTE 3—The D-Load is the three-edge bearing strength per unit length divided by the inside diameter.

NOTE 4—Other strength categories shall be permitted by agreement between the purchaser and the manufacturer.

5. Materials and Manufacture

5.1 *Wall Composition*—The wall composition shall consist of a thermosetting resin and aggregate.

5.1.1 *Thermosetting Resin*—The resin shall have a minimum deflection temperature of 158°F (70°C) when tested at 264 psi (1.820 mPa) following Test Method D648. The resin content shall not be less than 7 % of the weight of the sample as determined by Test Method D2584.

5.1.2 *Aggregate*—Aggregate, and mineral fillers tested in accordance with all requirements of Test Methods C117 and C136/C136M, except requirements for gradation shall not apply.

5.2 *Joints*—The pipe shall have a gasket sealed joining system that shall prevent leakage of fluid in the intended service condition.

5.2.1 *Couplings*—Stainless Steel 316, in accordance with Specification A276/A276M, or a glass-fiber-reinforced-thermosetting-resin coupling which uses an elastomeric seal. Alternate materials may be permitted by agreement between the purchaser and the manufacturer. Figs. 1 and 2 show typical couplings.

5.2.2 *Gaskets*—Elastomeric gaskets used with this pipe shall conform to the requirements of Specification F477, except that composition of the elastomer shall be as agreed

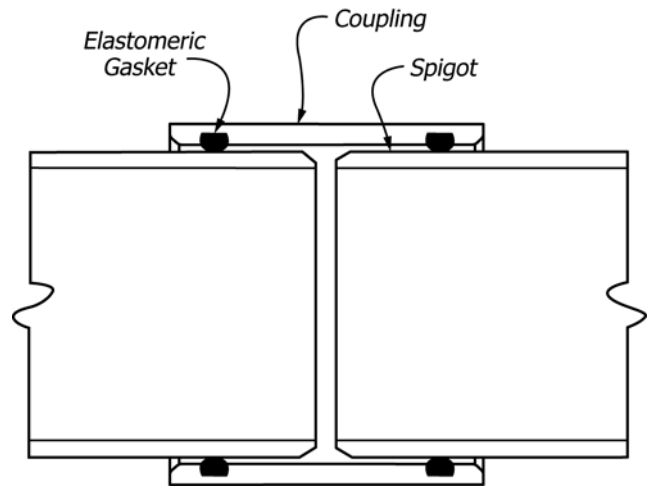


FIG. 1 Typical Coupling Joint Detail

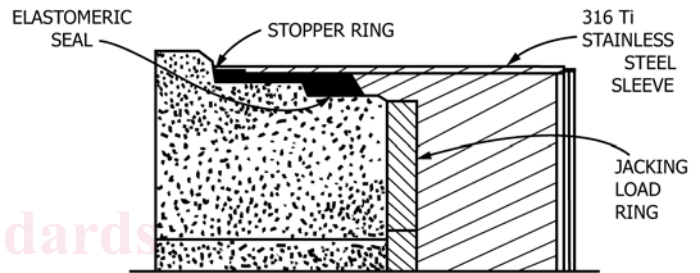


FIG. 2 Typical Jacking Pipe Joint

upon between the purchaser and the supplier as being resistant to the intended chemical environments.

6. Requirements

6.1 *Workmanship*—Each pipe shall be free from all defects, including indentations, cracks, foreign inclusions, and resin-starved areas that, due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.1.1 The inside surface of each pipe shall be free of bulges, dents, ridges, and other defects that result in a variation of inside diameter of more than 1/8 in. (3.2 mm) from that obtained on adjacent unaffected portions of the surface.

6.1.2 Joint sealing surfaces shall be free of dents, gouges, and other surface irregularities that will affect the integrity of the joints.

6.2 *Dimensions:*

6.2.1 *Pipe Diameter*—The pipe shall be supplied in the nominal diameters shown in Table 2 when measured in accordance with 8.1.1.

6.2.2 *Lengths*—Pipe shall be supplied in nominal lengths of 3, 4, 5, 6, 8, and 10 ft (0.92, 1.22, 1.52, 1.83, 2.44, and 3.05 m) unless otherwise agreed to between purchaser and seller. Tolerance on length shall be ±2 in. (±50 mm). The pipe shall be measured in accordance with 8.1.2.

6.2.3 *Wall Thickness*—The average wall thickness of the pipe shall not be less than the nominal wall thickness published

TABLE 1 Strength Classes for Polymer Concrete Pipe

Strength Class	D-Load lb/ft/ft (kN/m/m)
I	1200 (57.5)
II	1500 (71.9)
III	2000 (95.8)
IV	3000 (143.8)
V	3750 (179.7)

TABLE 2 Diameters for Polymer Concrete Pipe

Nominal Diameter, in.	Inside Diameter in. (mm)	Tolerance on ID in. (mm)
6	6.00 (152.4)	± 0.25 (6.4)
8	8.00 (203.2)	± 0.25 (6.4)
10	10.00 (254.0)	± 0.25 (6.4)
12	12.00 (304.8)	± 0.25 (6.4)
14	14.00 (355.6)	± 0.25 (6.4)
15	15.00 (381.0)	± 0.25 (6.4)
16	16.00 (406.4)	± 0.25 (6.4)
18	18.00 (457.2)	± 0.25 (6.4)
20	20.00 (508.0)	± 0.25 (6.4)
21	21.00 (533.4)	± 0.25 (6.4)
24	24.00 (609.6)	± 0.25 (6.4)
27	27.00 (685.8)	± 0.27 (6.4)
30	30.00 (762.0)	± 0.30 (7.6)
33	33.00 (838.2)	± 0.33 (8.4)
36	36.00 (914.4)	± 0.36 (9.1)
39	39.00 (990.6)	± 0.39 (9.9)
42	42.00 (1066.8)	± 0.42 (10.7)
45	45.00 (1143.0)	± 0.45 (11.4)
48	48.00 (1219.2)	± 0.48 (12.2)
51	51.00 (1295.4)	± 0.51 (13.0)
54	54.00 (1371.6)	± 0.54 (13.7)
60	60.00 (1524.0)	± 0.60 (15.2)
66	66.00 (1676.4)	± 0.66 (16.8)
72	72.00 (1828.8)	± 0.72 (18.3)
78	78.00 (1981.2)	± 0.78 (19.8)
84	84.00 (2133.6)	± 0.84 (21.3)
90	90.00 (2286.0)	± 0.90 (22.9)
96	96.00 (2438.4)	± 0.96 (24.4)
102	102.00 (2590.8)	± 1.00 (25.4)
108	108.00 (2743.2)	± 1.00 (25.4)
114	114.00 (2895.6)	± 1.00 (25.4)
120	120.00 (3048.0)	± 1.00 (25.4)
132	132.00 (3352.8)	± 1.00 (25.4)
144	144.00 (3657.6)	± 1.00 (25.4)

NOTE 1—Other diameters shall be permitted by agreement between the purchaser and the manufacturer.

in the manufacturer’s literature current at the time of purchase, when measured in accordance with 8.1.3.

6.2.4 Straightness of Pipe:

6.2.4.1 *Direct Bury Pipe*—Pipes shall not deviate from straight by more than 0.10 in./ft (8.3mm/m) for nominal diameters through 39 inch, 0.12 in./ft (10mm/m) for nominal diameters 42 in. through 78 in. and 0.14 in./ft (11.7mm/m) for nominal diameters 84 in. through 144 in. when measured in accordance with 8.1.4.

6.2.4.2 *Jacking Pipe*—Pipes shall not deviate from straight by more than 0.04 in./ft (3.3 mm/m) for nominal diameters through 39 inch, 0.06 in./ft (5.0mm/m) for nominal diameters 42 in. through 78 in., and 0.08 in./ft (6.7mm/m) for nominal diameters 84 in. through 144 in. when measured in accordance with 8.1.4.

6.2.5 *Roundness of Pipe*—The outside diameter shall not vary from a true circle by more than 1.0 % when measured in accordance with 8.1.5.

6.2.6 Squareness of Pipe Ends:

6.2.6.1 *Direct Bury Pipe*—The ends of the pipe shall be perpendicular to the longitudinal axis within ± 0.25 in. (± 6.4 mm) or ± 0.5 % of the nominal diameter, whichever is the greater, when tested when tested in accordance with 8.1.6

6.2.6.2 *Jacking Pipe* —The ends of the pipe shall be perpendicular to the longitudinal axis within 0.06 in. (1.5mm) for nominal diameters through 39 inch, 0.12 inch (3mm) for

nominal diameters 42 inch through 102 inch and 0.20 inch (5mm) for diameters 108 inch through 144 inch, when tested in accordance with 8.1.6.

6.3 *Three-Edge Bearing*—The pipe shall withstand, without failure, the three-edge bearing loads specified in Table 1 when tested in accordance with 8.2.

6.4 *Hydrostatic Pressure*—The pipe shall withstand an internal pressure of 35 psi (0.25 mPa) when tested in accordance with 8.3.

6.5 *Compressive Strength*—The minimum axial compressive strength shall be 10 000 psi (68.9 mPa) when tested in accordance with 8.4.

6.6 Chemical Resistance:

6.6.1 *Long Term*—When tested in accordance with 8.5, the extrapolated 50 year strength value shall be at least 50 % of the initial three-edge bearing strength of the test pipes.

6.6.2 *Control Requirements*—When tested in accordance with 8.5, pipe specimens shall be capable of sustaining without failure for 1 000 h a load equal to 60 % of the initial three-edge bearing strength of the test pipes.

6.7 Joint Tightness:

6.7.1 *Direct Bury Pipe*—The joint shall meet the laboratory performance requirements of Specification D4161, except that the internal pressure shall be 35 psi (0.25 mPa) and the minimum test time shall be 15 min.

6.7.2 *Jacking Pipe*—The joint shall meet the laboratory performance requirements of Specification D4161, except that the internal pressure shall be 35 psi (0.25 mPa), the minimum test time shall be 15 min, and the joint angle as illustrated in Fig. 2 of D4161 shall not apply. The joint test angle shall be the maximum allowed deflection angle as designed and specified by the manufacturer, but shall not be less than 0.50 degrees.

7. Sampling

7.1 *Lot*—Unless otherwise agreed upon between the purchaser and supplier, one lot shall consist of a manufacturing run of no more than 100, but at least 20, lengths of pipe of each diameter and strength class produced.

7.2 *Production Tests*—Select one pipe at random from each lot to determine conformance of the material to the workmanship, dimensional, and physical requirements of 6.1, 6.2, 6.3 and 6.5, respectively.

7.2.1 *Pipe Acceptance*—If the tested specimen of a designated lot passes the test, the entire lot shall be acceptable. If the tested specimen of a designated lot fails to pass the test, then five additional specimens from that same lot shall be selected for testing. If the five additional specimens pass, the lot shall be acceptable. except the one previous failing specimen. If any of the five additional specimens fail, the entire lot shall be rejected.

7.3 *Qualification Tests*—Sampling for qualification tests (see 3.2.5) is not required unless otherwise agreed upon between the purchaser and the manufacturer. Qualification tests shall be conducted for changes in polymer aggregate and manufacturing process and for changes in pipe joint or gasket geometry. Qualification tests for which a certification and test

report shall be furnished when requested by the purchaser include the following:

7.3.1 *Hydrostatic Pressure Test*—(see 6.4).

7.3.2 *Chemical Resistance Test*—(see 6.6).

7.3.3 *Joint-Tightness Test*—(see 6.7).

7.4 *Control for Chemical Resistance Test*—Perform sampling and testing for the control requirements of the chemical resistance test at least once annually, unless otherwise agreed upon between the purchaser and the supplier.

7.5 For individual orders, conduct only those additional tests and number of tests specifically agreed upon between the purchaser and the supplier.

8. Test Methods

8.1 Dimensions:

8.1.1 Diameters:

8.1.1.1 *Inside Diameter*—Take inside diameter measurements at a point approximately 6 in. (152 mm) from the end of the pipe section using a steel tape or an inside micrometer with graduations of $\frac{1}{16}$ in. (1 mm) or less. Make two 90° opposing measurements at each point of measurement and average the readings.

8.1.1.2 *Outside Diameter*—Determine in accordance with Practice **D3567**.

8.1.2 *Length*—Measure the pipe with a steel tape or gage having graduations of $\frac{1}{16}$ in. (1 mm) or less. Lay the tape or gage on or inside the pipe and measure the overall length of the pipe.

8.1.3 *Wall-Thickness*—Determine in accordance with Practice **D3567**.

8.1.4 *Straightness of Pipe*—Place a straight edge along the entire length of the pipe barrel. Measure the maximum deviation from straightness. Take four measurements at 90° intervals around the pipe and report the maximum deviation.

8.1.5 *Roundness of Pipe*—Measure the maximum and minimum outside diameters at one location on the joint sealing surface of the pipe. The out of roundness is the difference between these two measurements.

8.1.6 *Squareness of Pipe Ends*—Place pipe on supports in a horizontal position. Measure against a flat surface or plane that is perpendicular to the pipe axis. Rotate the pipe and measure the maximum and minimum distances from the pipe end to the flat surface or plane that is perpendicular to the pipe axis. The squareness is the difference between the maximum and minimum values.

8.2 Three-Edge Bearing Test:

8.2.1 The test specimens shall be standard lengths of pipe or other lengths as approved by the purchaser.

8.2.2 *Three-Edge Testing Apparatus* (see **Fig. 3**):

8.2.2.1 The apparatus shall consist of hydraulic rams mounted in a frame, and that are capable of applying uniform loads to the pipe through an I-beam along the entire upper length of the test specimen.

8.2.2.2 The contact surfaces shall be an elastomeric material having a shore A instantaneous durometer hardness between 45 and 60.

8.2.2.3 The top contact surface shall be of rectangular cross-section, having an 8 in. (200 mm) width and a thickness not less than 1 in. (25 mm) or more than 1½ in. (38 mm).

8.2.2.4 The bottom part of the apparatus shall consist of a firmly positioned I-beam supporting the entire length of the pipe, positioned in the vertical plane, passing through the longitudinal axis of the pipe. Two contact surfaces of rectangular cross-section, having a 2 in. (51 mm) width, and a thickness not less than 1 in. (25 mm) nor more than 1½ in. (38 mm) shall be attached to the entire length of the lower I-beam. The bottom contact surfaces shall be spaced apart 1 in./ft (83 mm/m) of pipe diameter, but in no case less than 1 in. (25 mm).

8.2.2.5 The apparatus shall be capable of applying a load at a uniform rate of $2\,000 \pm 500$ lbf/min/linear ft (29.4 ± 7.4 kN/min/linear m).

8.2.3 Test Procedure:

8.2.3.1 The load shall be applied at a uniform rate of $2\,000 \pm 500$ lbf/min/linear ft (29.4 ± 7.4 kN/min/linear m) of pipe length.

8.2.3.2 Test each pipe specimen in accordance with this method until the load required for the strength class (see **Table 1**) has been reached without visible damage to the pipe. The loading may be stopped after the required strength has been met, but before the pipe fails. Calculate the three-edge bearing strength by dividing the applied load by the inside length of the barrel. Calculate the D-Load by dividing the three-edge bearing strength by the inside diameter.

8.3 *Hydrostatic Pressure Test*—When the pipe is subjected to an internal hydrostatic pressure of 35 psi (0.25 mPa), and tested with restrained ends for 15 min there shall be no leakage on the exterior of the pipe. Moisture appearing on the surface of the pipe in the form of beads adhering to the surface shall not be considered leakage. However, moisture that starts to run on the pipe shall be construed as leakage, regardless of the quantity.

8.4 *Compressive Strength Test*—Determine in accordance with Test Method B of Test Method **C579** except that the test specimens shall be sections cut from pipe with a dimensional ratio of 1:1:2 with a minimum cross-sectional area of 1 in.² (650 mm²). The longest dimension shall be in the direction of the longitudinal axis of the pipe. Test specimens may be also taken from samples molded at the same time as the pipe is produced, using the same materials used to manufacture the pipe.

8.5 Chemical Resistance Test:

8.5.1 *Test Specimens*—The test specimens shall be ring sections taken from pipes selected at random from a production run of pipe.

8.5.1.1 *Length*—The test specimens shall have a length of 12 in. (300 mm) $\pm 5\%$.

8.5.1.2 *Diameter*—The test specimens shall all be of the same nominal diameter and strength class.

8.5.2 *Apparatus*—The loading frame shall be capable of applying and maintaining a load perpendicular to the pipe axis throughout the test period, despite any change in the vertical diameter of the test specimen. The loading frame contact surfaces shall conform to **8.2.2.2 – 8.2.2.4**.