



Designation: D6041 – 23

Standard Specification for Contact-Molded “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Corrosion Resistant Pipe and Fittings¹

This standard is issued under the fixed designation D6041; 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 pipe and fittings fabricated by contact molding, for pressures to 150 psi and made of a commercial-grade polyester resin. Included are requirements for materials, properties, design, construction, dimensions, tolerances, workmanship, and appearance.

1.2 This specification does not cover resins other than polyester, reinforcing materials other than glass fibers or fabrication methods other than contact molding.

NOTE 1—For the purposes of this specification, the term polyester resin will include both polyester and vinylester resins.

1.3 This specification does not cover the design of pipe and fittings intended for use with liquids heated above their flash points.

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

1.5 The following precautionary caveat pertains only to Section 10, the test methods portion, 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.

1.6 *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.*

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. Referenced Documents

2.1 ASTM Standards:²

C581 Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service

C582 Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment

D618 Practice for Conditioning Plastics for Testing

D638 Test Method for Tensile Properties of Plastics

D648 Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position

D883 Terminology Relating to Plastics

D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2583 Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor (Withdrawn 2022)³

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

D5421 Specification for Contact Molded “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Flanges

F412 Terminology Relating to Plastic Piping Systems

2.2 ANSI Standards:

B16.1 Cast Iron Pipe Flanges and Flanged Fittings⁴

B16.5 Pipe Flanges and Flanged Fittings⁴

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

⁴ Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

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

B18.22 Type “B” Narrow Washers⁴

2.3 National Sanitation Foundation Standard:

NSF Standard 61 Drinking Water System Components—Health Effects⁵

3. Terminology

3.1 Definitions:

3.1.1 *General*—Definitions are in accordance with Terminology **D883** and Terminology **F412** and abbreviations are in accordance with Terminology **D1600**, unless otherwise indicated. The abbreviation for reinforced thermosetting resin pipe is RTRP.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *contact molding, n*—a process for molding reinforced plastics in which reinforcement and resin are placed on an open mold or mandrel by either the “hand lay-up”(where resin and glass mat are applied by hand), or the “spray-up” manufacturing processes (where resin and chopped glass fibers are sprayed under pressure), or a combination of the two. The resulting laminate is then consolidated by rolling and cured without the application of pressure.

3.2.2 *fiberglass pipe, n*—a tubular product containing glass fiber reinforcements embedded in or surrounded by cured thermosetting resin. The composite structure may contain granular or platelet fillers, thixotropic agents, pigments, or dyes. Thermoplastic or thermosetting liners may be included.

3.2.3 *polyester, n*—resins produced by the polycondensation of dihydroxy glycols and dibasic organic acids or anhydrides, wherein at least one component contributes ethylenic unsaturation yielding resins that can be compounded with styrol monomers and reacted to give highly crosslinked thermoset copolymers.

3.2.4 *vinyl ester, n*—resins characterized by reactive unsaturation located predominately in terminal positions that can be compounded with styrol monomers and reacted to give highly crosslinked thermoset copolymers.

4. Materials and Manufacture

NOTE 3—Specification **C582** provides additional information on the materials and manufacturing of contact-molded laminates.

NOTE 4—Fiberglass pipe intended for use in the transport of potable water should be evaluated and certified as safe for this purpose by a testing agency acceptable to the local health authority. The evaluation should be in accordance with requirements for chemical extraction, taste, and odor that are no less restrictive than those included in National Sanitation Foundation (NSF) Standard 61. The seal or mark of the laboratory making the evaluation should be included on the fiberglass pipe.

4.1 Resin System:

4.1.1 The resin used shall be a commercial grade, corrosion-resistant polyester that has been determined to be acceptable for the service either by test, (see Practice **C581**), or by previous documented service. Where service conditions have not been evaluated a suitable resin may also be selected by agreement between manufacturer and purchaser.

NOTE 5—The use of “previous documented service” needs to be

approached carefully. It is not uncommon for specified operating conditions to be overstated in an attempt to achieve a higher safety margin.

4.1.1.1 The use of one resin in the corrosion barrier and a different resin in the structural layer (see Section 6) is permitted with the acceptance of the purchaser.

4.1.2 *Additives*, such as additional styrene, fillers, dyes, pigments, or flame retardants may be used when agreed upon between the manufacturer and purchaser. Thixotropic agents may be added to the resin for viscosity control.

NOTE 6—The addition of fillers, dyes, pigments, flame retardants, and thixotropic agents may interfere with visual inspection of laminate quality.

NOTE 7—Chemical resistance can be affected by the catalyst/promoter system, diluents, dyes, fillers, flame retardants, or thixotropic agents used in the resin.

NOTE 8—Antimony compounds or other fire-retardant agents may be added to halogenated resins for improved fire resistance, if agreed upon between the manufacturer and the purchaser. These compounds do not improve the flame retardancy of non-halogenated resins.

4.1.3 *Ultraviolet Absorbers* may be added for improved weather resistance when agreed upon between the manufacturer and the purchaser.

4.1.4 *Resin Putty*, used where necessary to fill crevices at joints prior to applying the joint laminate shall not be subject to the limitations of 4.1.3. Putty shall be made with resin and fillers. The resin used in the putty must be compatible with the resin used in the pipe and fittings.

4.2 Fiber Reinforcements:

4.2.1 *Surfacing Mat (Veil)* is a thin mat of fine fibers used primarily to produce a smooth and corrosion-resistant resin-rich surface on a reinforced plastic laminate.

4.2.1.1 Veils are made from chemical resistant (type “C”) glass or organic fiber. The use of an organic-fiber surface mat is recommended for environments that attack glass. The veil used in a laminate shall be determined to be acceptable for the chemical service either by Practice **C581** or by verified case history.

4.2.1.2 The veil shall be a minimum of 10 mils in dry thickness and produce a thickness of 0.010 to 0.020 in. (0.25 to 0.50 mm) when saturated with resin.

NOTE 9—The primary chemical resistance of the RTR pipe is provided by the resin. In combination with the cured resin, the surfacing veil helps determine the thickness of the resin-rich layer, and reduces micro cracking.

4.2.2 *Chopped-strand Reinforcements* shall be “E”-type or “ECR”-type glass fibers 1 to 2 in. (25 to 50 mm) long applied in a uniform layer with random orientation. The fibers shall have a sizing compatible with the selected resin. Chopped strand reinforcements may be purchased and applied as a mat or as continuous strand roving which is chopped into short lengths and sprayed onto the laminate in a process known as “spray up.” Either form is most commonly applied in layers weighing 1½ oz/ft² (450 g/m²) although other weights are available and may be used.

4.2.3 *Woven Roving*, shall be “E”-type or “ECR”-type glass roving, woven into a fabric. The sizing on the roving shall be compatible with the selected resin. The most common woven roving has a 5 by 4 weave and a weight of 24 oz/yd² (832 g/m²).

⁵ Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, <http://www.nsf.org>.