Designation: D4161 – 24

Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals[1]

This standard is issued under the fixed designation D4161; 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 axially unrestrained bell-and-spigot gasket joints including couplings required for machine-made "fiberglass" (glass-fiber-reinforced thermosetting-resin) pipe systems, 8 in. (200 mm) through 156 in. (4000 mm), using flexible elastomeric seals to obtain soundness. The pipe systems include pressure (typically up to 250 psi) or nonpressure systems for water or for chemicals or gases that are not deleterious to the materials specified in this specification. This specification covers materials, dimensions, test requirements, and methods of test.

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

NOTE 1—There is a similar but technically different ISO Standard (ISO 8639).

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 *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]

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics (Withdrawn 2024)[3]

F412 Terminology Relating to Plastic Piping Systems

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

3. Terminology

3.1 *Definitions:*

3.1.1 *General*—Definitions and abbreviations are in accordance with Terminology D883 or Terminology F412, and Terminology D1600 unless otherwise indicated.

4. Types of Joints

4.1 This specification covers two types of axially unrestrained joints based on effecting soundness of the joint through compression of an elastomeric seal or ring:

4.1.1 Bell-and-spigot or coupling joint with the gasket placed in the bell in circumferential compression. An elastomeric gasket joint design featuring a continuous elastomeric ring gasket placed in an annular space provided in the bell or socket of the pipe or fitting. The spigot end of the pipe or fitting is forced into the bell, thereby compressing the gasket radially to form a positive seal.

4.1.2 Bell-and-spigot or coupling joint with the gasket placed on the spigot in circumferential tension: A push on joint design featuring a continuous elastomeric ring gasket placed in an annular space provided on the spigot end of the pipe or fitting. The spigot is forced into the bell of the pipe or fitting, thereby compressing the gasket radially to form a positive seal.

NOTE 2—A coupling joint of these types is a loose double-bell sleeve used to connect pipes which have spigots at both ends (see Fig. 1). All references to bells in this specification are applicable to the sleeve coupling as well as to the integral bell of a bell-and-spigot gasket joint.

5. Materials and Manufacture

5.1 The gasket shall be a continuous elastomeric ring of circular or other geometric cross section and shall meet the requirements of Specification F477, unless otherwise specified

[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 www.astm.org/contact. 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.

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

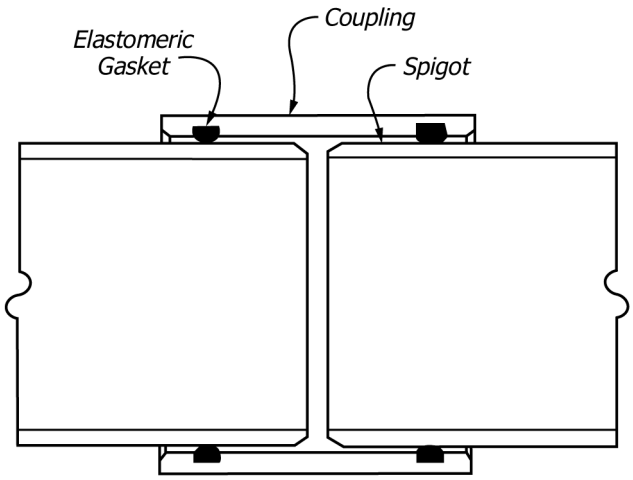

FIG. 1 Typical Coupling Joint Detail

in this specification. When a splice is used in the manufacture of the gasket, no more than two splices shall be made in any one gasket.

5.1.1 The chemical composition of the gasket shall be compatible with the type of environment to which it will be subjected. Selection of the gasket composition shall be in accordance with a purchaser and seller agreement.

NOTE 3—Consult the gasket manufacturer for advice as to the suitability of specific rubber compounds for the intended service and joint configurations. Items such as cold set when the joint is deflected under low-temperature conditions and maximum and minimum stretch in the gasket may be dependent upon the specific chemical compounds used.

5.2 Materials in the bell and spigot of the joint shall meet the requirements of the applicable ASTM specification for the pipe or fitting of which the joint is a part.

6. Requirements

6.1 *Joint Surfaces*—All surfaces of the joint upon or against which it is possible that the gasket will bear shall be smooth and free of cracks, fractures, or other imperfections that would adversely affect the performance of the joint.

6.2 *Joint Geometry*—The design of the joint shall include a means to retain the gasket and prevent it from being unintentionally displaced, either during assembly of the joint or during operation of the completed pipe system.

6.3 *Dimensions and Tolerances*—The provisions of 6.3.1.1 apply only to a joining system utilizing a gasket of circular cross section retained in a rectangular groove. It is acceptable for manufacturers to submit to the purchaser detailed designs for joints utilizing gaskets or grooves, or both, of other geometric shape or for joints not meeting the criteria of 6.3.1. Joints not meeting the requirements of this section shall meet the test requirements of Section 7; such joints shall be acceptable, provided the design is approved by the purchaser prior to manufacture and provided the test pipe complies with the specified test requirements. Test results are applicable to other diameters with the same joint configuration, gasket shape and gasket composition provided substantially similar gasket compressions and gasket hardness are maintained. Increased or decreased gasket dimensions are permitted provided joint geometry is also appropriately proportioned so that critical relationships like gasket confinement are equal or superior to the tested joint. Design submissions shall include joint geometry, tolerances, gasket characteristics, proposed plant tests, and such other information as required by the purchaser to evaluate the joint design for field performance.

6.3.1 *Joints Using Circular Gasket Cross Sections:*

6.3.1.1 The volume of the annular space provided for the gasket, with the engaged joint at normal joint closure in concentric position, and neglecting ellipticity of the bell and spigot, shall not be less than the design volume of the gasket furnished. For a rectangular gasket groove, the cross-sectional area of annular space shall be calculated for minimum bell inside diameter, maximum spigot outside diameter, minimum width of groove at surface of spigot, and minimum depth of groove. The volume of the annular space shall be calculated at the centerline of the groove and considering the centroid of the cross-sectional area to be at the midpoint between the surface of the groove on which the gasket is seated and the surface of the bell, if the groove is on the spigot, or the surface of the spigot, if the groove is in the bell.

6.3.1.2 When the design volume of the gasket is less than 75 % of the volume of the annular space in which the gasket is confined, the dimensions and tolerances of the gasket, bell, and spigot shall be such that, when the outer surface of the spigot and the inner surface of the bell come into contact at some point in their periphery, the deformation in the gasket shall not exceed 40 % at the point of contact nor be less than 15 % at any point. If the design volume of the gasket is 75 % or more of the volume of the annular space, the deformation of the gasket, as prescribed above, shall not exceed 50 % nor be less than 15 %. The cross-sectional area of annular space shall be calculated for average bell diameter, average spigot diameter, average width of groove at surface of spigot, and average depth of groove. The volume of the annular space shall be calculated at the centerline of the groove and considering the centroid of the cross-sectional area to be at the midpoint between the surface of the groove on which the gasket is seated and the surface of the bell, if the groove is on the spigot, or the surface of the spigot, if the groove is in the bell.

NOTE 4—It is recognized that a relationship exists between the water-tightness of a joint, the gasket deformation, and the ratio of gasket volume to space volume. For high-pressure applications, it may be necessary to provide a very high-volume ratio to obtain a sound joint. Some manufacturers also have developed satisfactory joints with very little gasket deformation, but meet the requirements of Section 6 by utilizing a very high-volume ratio.

6.3.1.3 When determining the maximum percent deformation of the gasket, the minimum depth of groove and the stretched gasket diameter shall be used and calculations made at the centerline of the groove. When determining the minimum percent deformation of the gasket, the maximum bell diameter, the minimum spigot diameter, the maximum depth of groove, and the stretched gasket diameter shall be used and calculations made at the centerline of the groove. For gasket deformation calculations, if the gasket is placed on the spigot in circumferential tension, the stretched gasket diameter shall be determined as being the design diameter of the gasket divided by the square root of $(1 + x)$ where x equals the design