Designation: D3139 – 98 (Reapproved 2011)

Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals[1]

This standard is issued under the fixed designation D3139; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers the types of joints required for plastic pipe pressure systems with a wall thickness equal to or greater than that of SDR 64 and intended for use in supply and distribution lines for water, using flexible elastomeric seals. This specification covers the test requirements, test method, and materials. The test methods described are not intended to be routine quality control tests, but are to evaluate the performance characteristics of the joint.

1.2 The text of this specification references notes, footnotes, and appendixes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

1.3 The following safety hazards caveat pertains to the test method portion, Section 6, 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

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

2.2 *AWWA Standard:*

AWWA C651 Standard for Disinfecting Water Mains[3]

2.3 *NSF Standard:*

ANSI/NSF Standard No. 61 for Drinking Water System Components-Health Effects[4]

3. Terminology

3.1 *Definitions:*

3.1.1 This specification covers two types of mechanical joints based on effecting water tightness through compression of an elastomeric seal or ring:

3.1.2 *mechanical joint*—a joint in which a positive seal is achieved when a gasket is compressed by means of a mechanical device.

3.1.3 *push-on-joint*—a joint in which a continuous elastomeric ring gasket is compressed into an annular space formed by the pipe or fitting socket and the spigot end of the pipe, and forms a positive seal after being assembled. Details of the joint design and assembly shall be in accordance with the manufacturer's instructions.

4. Materials and Manufacture

4.1 The materials used in elastomeric seals shall meet the requirements of Specification F477.

4.2 *Lubricant*—The lubricant shall be nontoxic and shall have no deteriorating effects on the gasket and pipe materials. It shall not impart taste or odor to water in a pipe that has been flushed in accordance with AWWA C651. When used in a potable water system, the lubricant shall meet the requirements of ANSI/NSF Standard No. 61. The lubricant container shall be labeled with the manufacturer's trademark or the pipe manufacturer's name.

5. Performance Requirements

5.1 The joint shall be designed to provide a permanent seal and shall be qualified in accordance with Section 8.

5.1.1 All surfaces of the joint upon or against which the gasket may bear shall be free of imperfections that could adversely affect the performance of the joint.

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[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.20 on Joining.

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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 Water Works Association (AWWA), 6666 W. Quincy Ave., Denver, CO 80235, http://www.awwa.org.

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

5.2 *Pressure Rating*—Designs not meeting the requirements of 6.2 shall be tested to verify that the hydrostatic design basis category for joint assemblies shall not be lower than the hydrostatic design basis category for pipe when tested under the same procedure. The hydrostatic design basis for this joint design shall be established on a representative size at a minimuim test level of 10 points and 2000 h in accordance with Test Method D2837, except that the ends shall be restrained. Test pressure levels for establishing hydrostatic design basis shall be calculated on pipe minimum wall dimensions.

5.2.1 Joint designs shall require retesting under this section only if the joint design is changed or if the pipe compound is altered in any manner that produces a lower hydrostatic design basis category when compared with the compound used in the previous validation testing of the joint design.

5.3 *Mechanical Joint*—The mechanical joint shall provide a pressure rating equal to or greater than that of the corresponding pipe.

5.3.1 *Internal Stiffener*—The pipe spigot shall have a wall thickness sufficient to withstand, without deformation or collapse, the compressive force exerted when the fitting is tightened. If the wall is not sufficient to withstand the compressive force, then a rigid tubular internal stiffener shall be used in conjunction with compressive-type mechanical joint fittings. A stiffener specified by the manufacturer for this purpose shall be used.

5.4 *Joint Deflection*—The joint shall provide a seal when the pipe spigot is deflected axially in the socket to the maximum unstressed limit permitted by dimensional clearance between the spigot and bell.

6. Dimensions, Mass, and Permissible Variations

6.1 *Joint Dimensions and Tolerances*—The dimensions of the bell, socket, and plain end shall be in accordance with the manufacturer's standard design dimensions of the joint.

6.2 *Push-On Joint*—The minimum wall thickness of the bell at any point between the ring groove (annular gasket space) and the pipe barrel, shall conform to the dimension ratio requirements for the pipe barrel. The minimum wall thickness in the sealing portion of the ring groove and bell entry sections shall equal or exceed the minimum wall thickness requirements of the pipe barrel (see Fig. 1 or Fig. 2).

6.3 *Gasket Dimensions*—Gasket dimensions shall be in accordance with the manufacturer's standard design dimensions and tolerances. The gasket shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal under all combinations of permitted joint and gasket tolerances. The gasket shall be the sole element depended upon to make the joint flexible and water tight. The gasket shall be a continuous elastomeric ring.

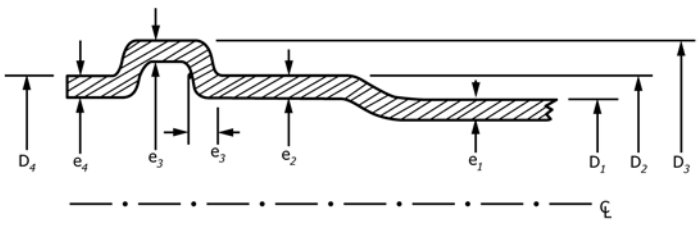
7. Workmanship, Finish, and Appearance

7.1 The manufacturer of these joints shall produce joints meeting the requirements of this specification. Components of the joints shall be homogenous throughout and free from visible cracks, holes, foreign inclusions, or injurious defects. The components of the joints shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

8. Test Methods

8.1 The assembled joints shall pass the following laboratory qualifying tests. (For referee testing, standard laboratory conditions of 73°F and 50 % relative humidity will apply.)

8.1.1 *Internal Pressure Testing*—Laboratory hydrostatic pressure tests on joints shall be made on an assembly of two sections of pipe properly connected in accordance with the joint design and deflected to the limit defined in 5.4. No coatings, fillings, or packings, other than lubricants recommended in 4.2, shall be placed prior to water tightness tests. After the pipe sections are fitted together with the gasket or gaskets in place, the assembly shall be subjected to separate internal pressure tests, first at 50 % of rated pressure for 60 min, then at 2½ times the rated pressure for 60 min without leakage at either pressure for the duration of either test. The pressure shall then be continuously increased to the minimum short-term rupture requirement of the applicable pipe without leakage. The pressure increase from 2½ times rated to minimum short-term rupture requirement shall occur over a 60 to 70-s period.

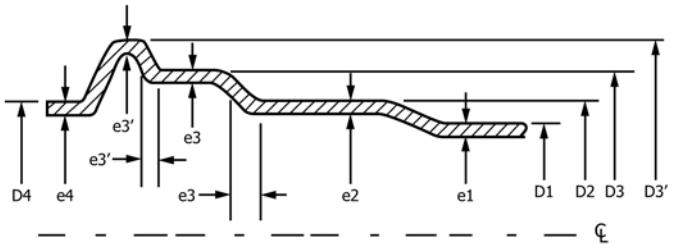


C_L = center line
D_1 = average outside diameter - pipe
D_2 = average outside diameter - socket
D_3 = average outside diameter - annular gasket space
D_4 = average outside diameter - entry lip
e_1 = minimum wall thickness - pipe
e_2 = minimum wall thickness - socket
e_3 = minimum wall thickness - sealing portion of the annular gasket space
e_4 = minimum wall thickness - entry lip
S_W = hydrostatic design stress

P_W = pressure rating shall be determined as follows:

$S_W = P_W(D - e)/2e$ (Method D 2837)
$e_1 = D_1[(2S_W/P_W) + 1]$
$e_2 = D_2/[(2S_W/P_W) + 1]$
$e_3 \geq e_1$
$e_4 \geq e_1$
$[(2S_W/P_W) + 1] = SDR$

FIG. 1 Relationship of Dimensions in 6.2



C_L = center line
D_1 = average outside diameter - pipe
D_2 = average outside diameter - socket
D_3 = average outside diameter - sealing portion of the annular gasket space
D_3' = average outside diameter - locking portion of the annular gasket space
D_4 = average outside diameter - entry lip
e_1 = minimum wall thickness - pipe
e_2 = minimum wall thickness - socket
e_3 = minimum wall thickness - sealing portion of the annular gasket space
e_3' = minimum wall thickness - locking portion of the annular gasket space
e_4 = minimum wall thickness - entry lip

S_W = hydrostatic design stress
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$S_W = P_W(D - e)/2e$ (Method D 2837)
$e_1 = D_1[(2S_W/P_W) + 1]$
$e_2 = D_2/[(2S_W/P_W) + 1]$
$e_3 \geq e_1$
$e_3' \geq 0.9e1$
$e_4 \geq e_1$

FIG. 2 Relationship of Dimensions in 6.2

8.1.2 *Vacuum Test*—The assembled joint shall withstand a vacuum of 75-kPa gage (22 in. Hg) for 1 h with no leakage while in the auxiliary deflected position in accordance with 8.1.1.

9. Rejection and Rehearing

9.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) shall be conducted again only by agreement between the purchaser and the seller. Under such agreement, minimum requirements shall not be lowered, nor tests omitted, substituted, changed, or modified, nor shall specification limits be changed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

10. Certification

10.1 When specified in the purchase order or contract, the purchaser shall be furnished certification by affidavit that samples representing each lot of production have been either tested or inspected as directed in this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test or inspection results shall be furnished.

11. Keywords

11.1 compression-type; elastometric; joints; push-on joint; rigid; seals