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Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe[1]

This standard is issued under the fixed designation F913; 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 thermoplastic elastomeric seals (gaskets) used to seal the joints of plastic pipe and fittings used for gravity and low-pressure applications.[2] This specification refers to push-on joints that require no internal or external pressure to effect the initial seal.

1.2 Requirements are given for thermoplastic elastomers.

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 The following precautionary 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

D573 Test Method for Rubber—Deterioration in an Air Oven

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

D1414 Test Methods for Rubber O-Rings

D1566 Terminology Relating to Rubber

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2240 Test Method for Rubber Property—Durometer Hardness

D6147 Test Method for Vulcanized Rubber and Thermoplastic Elastomer—Determination of Force Decay (Stress Relaxation) in Compression

F412 Terminology Relating to Plastic Piping Systems

F118 Definitions of Terms Relating to Gaskets

3. Terminology

3.1 *Definitions:*

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

3.1.2 Terms relating to rubber or elastomer shall be as defined in Terminology D1566 and Definitions F118.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *gravity and low pressure applications, n*—pressure below 150 kPa (21 psi) or (50-ft) head of water.

4. Materials and Manufacture

4.1 The gasket shall be fabricated from a high-grade thermoplastic elastomer meeting the requirements in Table 1.

4.2 The gasket shall meet the force decay (stress relaxation) requirements of 5.1.3.

4.3 The thermoplastic elastomer used must be noncrazing to pipe. The gasket shall not cause craze marks, pits, or blisters in contact with the plastic pipe. Staining of the plastic pipe in the area of gasket contact is acceptable. Test in accordance with 8.8 to qualify thermoplastic elastomers for pipe made from the plastic polymer in question.

4.4 Where the particular joint design utilizing a TPEL gasket dictates the use of lubricant to facilitate assembly, the lubricant shall be of such composition that will in no way damage the gasket or pipe due to prolonged exposure and shall not adversely affect the sealing capability of the gasket.

NOTE 1—By agreement between the purchaser and the manufacturer, chemical analysis may be required and limits established for elements or compounds not specified.

[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] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F17-1035.

[3] 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.

TABLE 1 Physical Property Requirements for Seals Made from Thermoplastic Elastomers (TPEL)

Properties	Condition	Test Method	Minimum Requirements
Tensile strength	unaged after oven aging for 96 h at 70°C	D412[A]	2 MPa (300 psi) minimum maximum change of 15%
Elongation	unaged after oven aging for 96 h at 70°C	D412[A]	350 % minimum maximum change of 20 %
Hardness	unaged after oven aging for 96 h at 70°C	D2240[A]	40 durometer A minimum maximum change of 8 units
Low temperature hardness	type A or D durometer −10°C	D2240[A]	maximum increase of 15 units
Ozone resistance	70 h at 50 pphm ozone at 40°C at 20 % extension	D1149	No cracks
Water immersion	after 48 h at 70°C	D471[A]	5 % maximum change in volume
Force Decay	after 168 h at 70°C	D6147	40 % minimum remaining

[A] For O-rings refer to Test Method D1414

5. Physical Requirements

5.1 The sealing portion of the gasket shall comply with the physical requirements listed in Table 1 when tested in accordance with the methods in Section 8.

NOTE 2—Some gasket incorporated a high durometer elastomeric or nonelastomeric, that is, metal or plastic material, as a reinforcement or retaining feature, or both. These materials do not alter the physical properties of the sealing portion of the gasket and should not be tested as such, or expected to meet the material requirements listed in Table 1.

NOTE 3—The materials used for retaining or reinforcement, or both, should not encroach upon the sealing surfaces of the gasket, and have physical properties which are adequate for the anticipated usage of the gasket.

5.1.1 *Hardness*—A variation of ± 5 points of Type A durometer from the manufacturer's specified hardness shall be allowed when tested in accordance with 8.3.

5.1.2 Elongation for the harder portion of multi-durometer gaskets shall not be less than 100 %. The elongation for the softer portion of the gasket shall meet the requirements of Table 1.

5.1.3 *Force Decay (Stress Relaxation)*—Using the procedure in D6147, the remaining stress shall be a minimum of 40 % of the initial stress. Testing shall be done at 70 ± 2°C (158 ± 4°F) for a minimum of 168 h. (Method B)

6. Dimensions, Mass, and Permissible Variations

6.1 When in its final assembled position, the gasket shall not be stretched more than 30 % of its original circumference.

NOTE 4—Excessive stretch may have deleterious effect on TPEL gaskets. The minimum stretch compatible with the proper performance of the gasket should be used at all times.

6.2 The gaskets shall conform to the dimensions specified by the manufacturer of the pipe or fittings with which the gaskets are to be used, with a tolerance of ± 3 % on all cross-sectional dimensions, and ± 1 % on all diametrical dimensions unless otherwise agreed upon by the pipe or fitting manufacturer and the purchaser.

6.3 For molded gaskets or gasket material, the permissible flash shall be a maximum of + 0.80mm (0.032 in.). Maximum mold mismatch shall not exceed 0.25 mm (0.010 in).

7. Workmanship, Finish, and Appearance

7.1 All gaskets shall be extruded or molded in such a manner that any cross section will be dense, homogeneous, and free of porosity, blisters, pitting, or other imperfections.

7.2 Where a splice is used in the manufacture of the gasket, the strength shall be such that the gasket shall withstand 100 % elongation over the part of the gasket that includes the splice with no visible separation of the splice. (While in a stretched position the gasket shall be rotated in the spliced area a minimum of 180° in each direction in order to inspect for separation. In addition, any portion of the splice shall be capable of passing a bend test without visible separation.) The bend test for circular gaskets is defined as wrapping the portion of the unstretched gasket containing the splice a minimum of 180° and a maximum of 270° around a rod of a diameter equal to the cross-section diameter of the gasket.

8. Test Methods

8.1 Perform laboratory tests to determine the physical properties of the gaskets to be furnished under this specification on: (*1*) the finished product as supplied, (*2*) test specimens taken from the finished product, or (*3*) from specimens of fabrication of the same elastomeric compound, and in accordance with the appropriate ASTM standard.

8.2 *Tensile Strength and Elongation*—Determine tensile strength and elongation in accordance with Test Methods D412 or Test Methods D1414 for O-rings.

8.3 *Hardness*—Determine the durometer, Type A, in accordance with Test Method D2240 or Test Methods D1414 for O-rings. Readings shall be taken after a 5-s delay.

8.4 *Low-Temperature Hardness*—Measure the durometer, Type A, in accordance with Test Method D2240 or Test Methods D1414 for O-rings after conditioning for 22 h at −10 ± 2°C (+14 ± 4°F) to determine the change in hardness. Readings shall be taken after a 5-s delay.

8.5 *Accelerated Aging*—Conditioning of samples for the determination of accelerated aging shall be in accordance with Test Method D573.

8.5.1 Age physical test specimens for 96 h at 70 ± 2°C (158 ± 4°F).

8.6 *Water Immersion*—Determine the change in volume in accordance with Test Method D471 or Test Methods D1414 for O-rings.

8.6.1 The temperature shall be 70 ± 2°C (158 ± 4°F), and the immersion period shall be 48 h.

8.6.2 Immediately after removal from the water, blot the specimens, weigh, and calculate the volume increase in accordance with Test Method D471.

8.7 *Ozone Resistance*—Determine the gasket's resistance to ozone in accordance with Test Method D1149.

8.7.1 Conduct test for 70 h in 50 pphm concentration at 40 ± 2°C (104 ± 4°F) with specimens stressed to 20 % extension.

8.8 Determine elastomer compound effect on pipe (4.3) by the following procedure:

8.8.1 The fixture for the test shall provide for direct contact between the plastic and the TPE gasket specimens and shall allow for 25 % compression of the rubber gasket.

8.8.2 Age the specimens under load with compression of the TPE at 25 % for 96 h at 70 ± 2°C (158 ± 4°F).

8.8.3 Let the specimens cool in the fixture for 24 h at 21 to 25°C (70 to 77°F).

8.8.4 Upon release, inspect the plastic bearing plate surface that has been in contact with the elastomeric compound for cracks, craze marks, pits, or blister (4.3).

8.9 *Force Decay (Stress Relaxation)*—Determine force decay in accordance with Test Method D6147.

8.9.1 Conduct test for 168 h at 70°C with specimens stressed to 25 % compression.

9. Inspection

9.1 Inspection of the material shall be agreed upon between the purchaser and the supplier as part of the purchase contract.

10. Rejection and Rehearing

10.1 Material that fails to conform to the requirements of this specification shall be rejected. Rejection shall be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

10.2 The TPEL gaskets shall be subject to rejection whenever they show surface checking, weathering, or other deterioration prior to installation.

11. Certification

11.1 When specified in the purchase order or contract, the purchaser shall be furnished certification that samples representing each lot 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 results shall be furnished.

12. Marking

12.1 The markings shall include the gasket manufacturer's name or symbol, gasket size, and manufacturer's code.

13. Storage

13.1 The TPEL gaskets should be stored in a cool, clean, shaded place.

14. Keywords

14.1 elastomeric; joining; piping; seals; thermoplastic