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An American National Standard

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

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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 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:*

D 412 Test Methods for Rubber Properties in Tension[3]

D 471 Test Method for Rubber Property—Effect of Liquids[3]

D 573 Test Method for Rubber—Deterioration in an Air Oven[3]

D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber (Flat Specimens)[3]

D 1414 Test Methods for Rubber O-Rings[4]

D 1566 Terminology Relating to Rubber[3,4]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[5]

D 2240 Test Method for Rubber Property—Durometer Hardness[3]

F 412 Terminology Relating to Plastic Piping Systems[6]

F 118 Definitions of Terms Relating to Gaskets[4]

3. Terminology

3.1 *Definitions—are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.*

3.2 Terms relating to rubber or elastomer shall be as defined in Terminology D 1566 and Definitions F 118.

3.3 *Definitions of Terms Specific to This Standard:*

3.3.1 *gravity and low pressure applications*—pressure below 50-ft head of water or 21 psi.

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 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.

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.

[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 are available at ASTM Headquarters. Request RR:F17-1035.

[3] *Annual Book of ASTM Standards*, Vol 09.01.

[4] *Annual Book of ASTM Standards*, Vol 09.02.

[5] *Annual Book of ASTM Standards*, Vol 08.01.

[6] *Annual Book of ASTM Standards*, Vol 08.04.

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

Properties	Condition	Test Method	Minimum Requirements
Tensile strength	unaged	D 412[A]	2 MPa (300 psi) minimum
	after oven aging for 96 h at 70°C		maximum change of 15%
Elongation	unaged	D 412[A]	350 % minimum
	after oven aging for 96 h at 70°C		maximum change of 20 %
Hardness	unaged	D 2240[A]	40 durometer A minimum
	after oven aging for 96 h at 70°C		maximum change of 8 units
Low temperature hardness	type A or D durometer −10°C	D 2240[A]	maximum increase of 15 units
Ozone resistance	70 h at 50 ppm ozone at 40°C at 20 % extension	D 1149	No cracks
Water immersion	after 48 h at 70°C	D 471[A]	5 % maximum change in volume
Stress relaxation			
initial stress	at 23 ± 2°C		500 to 1400 kPa (75 to 200 psi)
100 000 h extrapolation of % stress remaining	at 23 ± 2°C	Paragraph 8.9	40 % minimum remaining

[A] For O-rings refer to Test Method D 1414.

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 *Stress Relaxation*—Using the procedure in 8.9, the 100 000-h extrapolation of stress remaining shall be a minimum of 40 % of the initial stress which must be 500 to 1400 kPa. Testing shall be done at 23 ± 2°C for a minimum of 1000 h.

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 crosssectional 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 +0.80 mm (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 D 412 or Test Methods D 1414 for O-rings.

8.3 *Hardness*—Determine the durometer, Type A, in accordance with Test Method D 2240 or Test Methods D 1414 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 D 2240 or Test Methods D 1414 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 D 573.

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 D 471 or Test Methods D 1414 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 D 471.

8.7 *Ozone Resistance*—Determine the gasket's resistance to ozone in accordance with Test Method D 1149.

8.7.1 Conduct test for 70 h in 50 ppm 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).