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Standard Specification for Flexible Transition Couplings for Underground Piping Systems[1]

This standard is issued under the fixed designation C1173; 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 describes the properties of devices or assemblies suitable for use as flexible transition couplings, hereinafter referred to as couplings, for underground drainage and sewer piping systems.

1.2 Couplings that may include bushings, inserts, or shear rings and conform to the requirements of this standard are suitable for joining plain end pipe or fittings. The pipe to be joined shall be of similar or dissimilar materials, size, or both.

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 ASTM standards referenced herein shall be considered mandatory.

1.5 The committee with jurisdiction over this standard is not aware of another comparable standard for materials covered in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

A644 Terminology Relating to Iron Castings

D395 Test Methods for Rubber Property—Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D573 Test Method for Rubber—Deterioration in an Air Oven

D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D638 Test Method for Tensile Properties of Plastics

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

D2240 Test Method for Rubber Property—Durometer Hardness

D3045 Practice for Heat Aging of Plastics Without Load

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

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology A644.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *center stop, n*—an integral part of the gasket centered on its axial length intended to limit the insertion depth of the pipe to be coupled.

3.2.2 *clamp assembly, n*—that portion of the coupling excluding the gasket.

3.2.3 *coupling, n*—the complete assembly.

3.2.4 *fitting, n*—parts of a pipeline other than straight pipe couplings, or valves.

3.2.5 *flexible transition couplings, n*—devices used to form a leakproof joint between sections of plain end pipe or fittings of the same or different materials, of the same or different size, or any combination of materials or pipe sizes.

3.2.6 *free torque, n*—the torque value expressed in lbf·in./Nm when the clamp is tightened four revolutions of the screw nut; while in the free state, this value does not include any breakaway effects due to staking or passage of the band ends beyond the screw heads.

3.2.7 *inserts, n*—a bushing or ring placed into the coupling socket to accommodate pipe materials of differing outside diameters.

[1] This specification is under the jurisdiction of ASTM Committee A04 on Iron Castings and is the direct responsibility of Subcommittee A04.75 on Gaskets and Coupling for Plumbing and Sewer Piping.

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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.

3.2.8 *joint, n*—the completed assembly of parts consisting of the flexible transition coupling and the joined pipes, or fittings, or both.

3.2.9 *lot, n*—a specific quantity of similar material or collection of similar units from a common source; the quantity offered for inspection and acceptance at any one time. A lot might comprise a shipment, batch, or similar quantity.

3.2.10 *manufacturer, n*—the entity that produces the coupling.

3.2.11 *plain end pipe, n*—any pipe that does not include any bell, hub, threaded area, or other means of joining.

3.2.12 *shear ring, n*—an interior or exterior element which is used to span the distance between the pipe ends within a coupling so as to provide increased resistance to axial displacement.

4. Classification

4.1 The couplings shall be permitted to have a center stop. The components shall be designed so that the elastomeric material is compressed to form a hydrostatic seal when the joint is assembled. The couplings shall be of the types described in 4.1.1 – 4.1.3.

4.1.1 *Type A*—A coupling consisting of an elastomeric gasket incorporating corrosion resistant tension bands and tightening mechanism. Couplings shall be fabricated without shear rings, with or without inserts and with or without a center stop.

4.1.2 *Type B*—A coupling consisting of an elastomeric gasket incorporating a corrosion resistant shear ring, tension bands and tightening mechanism. Couplings shall be fabricated with shear rings, with or without inserts and with or without a center stop (Note 1).

4.1.3 *Type C*—A coupling fabricated with elastomeric compression seals.

NOTE 1—The provisions of this standard are not intended to prevent the use of any alternate material or method of construction, provided any such alternate meets the requirements of this standard.

5. Materials and Manufacture

5.1 Elastomeric materials used in the manufacturing of couplings and inserts shall comply with the requirements of section 10.1 and Table 1 of this standard.

5.2 All metallic components shall be manufactured of 300 series stainless steel.

6. Elastomeric Gasket Requirements

6.1 The elastomeric gasket shall conform to the physical properties as specified in section 5.1 of this standard.

6.2 Elastomeric gaskets and inserts of single, multi-piece, or spliced construction shall show no signs of separation, peeling, or other defects when tested in accordance with Section 9.

6.3 Elastomeric gaskets and inserts of single, multi-piece, or spliced construction shall be free from porosity and air pockets. Its surface shall be smooth and free from pitting, cracks, blisters, air marks, or any other imperfections that affect its performance in service. The flash extension shall not exceed 1 mm at any point where the presence of flash affects performance.

TABLE 1 Test Requirements

Properties	Physical Requirements	ASTM Test Method
Elastomeric Materials		
Hardness, Nominal Shore "A" Durometer as specified by the coupling manufacturer	50–75	D2240
Hardness, Nominal Shore "D" Durometer as specified by the coupling manufacturer	35–45	D2240
Tensile strength, min psi (KPa)	1000 (6894)	D412, Die C, Fig. 2 or D638
Elongation at rupture, min, %	200	D412, Die C, Fig. 2 or D638
Heat aging, 70 h, 158 ± 3.6°F (70 ± 2°C)		D573 or D3045
Hardness increase, maximum Durometer points	10	
Change in tensile strength, max, %	25	
Change in elongation, max, %	35	
Ozone resistance	No cracks	D1149
At 20 % elongation		
For 100 h at 104± 3.6°F (40 ± 2°C)		
With 50 parts per 100 million		
Water absorption, weight gain, %, max	20	D471
Chemical resistance, 48 h, 74± 3.6°F (23 ±2°C)	no weight loss	D543
Compression Set, max, %	25	D395 Method B
Stress Relaxation, min. % Force Retention	30	D6147
Tear Strength, min, lbf/in. (N/cm)	150 (268.5)	D624 Die C

6.4 Elastomeric gaskets and inserts shall be compatible with the dimensions and tolerances of the specific material to which it is designed to join.

7. Clamp Assembly Requirements

7.1 All metallic components shall be of 300 series stainless steel conforming to the requirements of Specification A240/A240M. All metallic components made from round stock shall be of 300 series stainless steel conforming to the requirements of Specification A493 (excluding copper bearing alloys).

7.2 Clamp assemblies, tension bands, tightening mechanisms shall conform to the performance requirements as set forth in section 10.2 of this standard.

8. Dimensions

8.1 Couplings and bushing dimensions shall be compatible with the dimensions and tolerances of the specific material to which it is designed to join.

9. Sampling, Tests, and Retests

9.1 Test specimens representative of the couplings to be used shall be randomly selected from the manufactured lot for testing.

9.2 One coupling for each size or type shall be tested, unless otherwise specified or waived by the purchaser.

9.3 Where there is a failure in the original test, the entire test shall be rerun with twice the number of samples and any failure shall be cause for rejection.

10. Test Methods

10.1 *Elastomeric Materials:*

10.1.1 *Hardness*—Hardness shall be measured on either a finished surface, a squarely cut end, or a flat sliced or buffed surface, depending on the size and shape of the specimen. See Test Method D2240. The manufacturer shall specify the hardness and scale.

10.1.2 *Tensile Strength and Elongation*— The dumbbells shall be prepared from sections of the finished material. See Test Method D412.

10.1.3 *Heat Aging*—for hardness, tensile and elongation shall be performed in accordance with Test Method D573. Specimens shall be oven-aged for 96 h at 158 ± 3.6°F (70 ± 2°C).

10.1.4 *Ozone Resistance*—See Test Method D1149. Procedure A, stretched 20 % and exposed to an ozone concentration of 50 parts per 100 million for 100 h at 104 ± 3.6°F (40 ± 2°C).

10.1.5 *Water Absorption*—Size and time determinations shall be set in accordance with Test Method D471. A specimen 0.075 by 1 by 2 in. (1.9 by 25 by 50 mm) shall be immersed in distilled water at 158 ± 3.6°F (70 ± 2°C) for 7 days. After seven days the specimen shall be removed, the surface moisture blotted and the specimen weighed. The percent gain shall be determined by the following equation:

$$\frac{(WF - WO)}{WO} \cdot 100$$

where:

WF = weight of specimen after immersion for 7 days, and

WO = dry weight of specimen before immersion.

10.1.6 *Chemical Resistance*—Samples shall be aged for 48 h at 74 ± 3.6°F (23 ± 2°C) using solutions of 1N sulfuric acid and 1N hydrochloric acid. See Test Method D543.

10.1.7 *Tear Strength*—The gasket material shall be tested in accordance with Test Method D624, Die C.

10.1.8 *Compression Set/Stress Relaxation*—Elastomeric materials shall comply with the compression set requirements of 10.1.8.1 or the stress relaxation requirements of 10.1.8.2.

10.1.8.1 The gasket material shall be tested for compression set in accordance with Test Method D395, Method B. Specimens shall be oven aged for 22 h at 70 ± 1°C (158 ± 2°F).

10.1.8.2 The gasket material shall be tested for stress relaxation in accordance with Test Method D6147, using Method B and test specimen as defined in 7.1.2 of D6147. The test temperature and duration shall be 168 h at 23 ± 2°C (73 ± 4°F).

10.2 *Clamp Assembly Performance :*

10.2.1 *Torque Resistance*—Clamp assemblies, tension bands and tightening mechanisms shall be tested to withstand the manufacturers required installation torque or a minimum of 60 in.-lb (8.5 N-m) of applied torque without visible signs of failure. The band shall be tested over a steel mandrel of the appropriate coupling diameter and torqued as required.

10.2.2 The maximum free running torque of stainless steel tension bands shall be 4 in.-lb (0.45 N-m). Stainless steel tension bands with torque resistance in excess of 100 in.-lb shall have a maximum free running torque of 8 in.-lb.

10.2.3 *Test Procedure for Free Running Torque:*

10.2.3.1 With the nonstressed clamp hand held and the slotted band fully engaged, the screw shall be rotated clockwise 10 revolutions with the maximum value of the torque meter recorded.

10.2.3.2 The equipment required shall be a hand held torque meter with a 0 to 15 in.-lb range.

10.3 *Coupling Performance Requirements:*

10.3.1 *Deflection Sealing Resistance*— The joint shall have sufficient flexibility to permit deflection in any direction as defined by Table 2 and shall show no visible leakage when so deflected while under an internal hydrostatic pressure of 4.3 psi (30 kPa) for a period of 15 min. The ends of the test pipe shall be restrained only by an amount necessary to prevent longitudinal movement. The deflection shall be measured as the distance the free end of the one pipe has moved away from the center line of the fixed pipe. See Fig. 1.

10.3.1.1 Assemble each coupling tested in accordance with the manufacturer's instructions between two sections of randomly selected pipe, not to exceed 5 ft in length, manufactured to appropriate standards for the type of pipe the couplings are expected to join.

10.3.1.2 Support one pipe section on two blocks, one near the uncoupled end of the pipe section and the other block immediately adjacent to the coupling. Firmly restrain pipe section one.

10.3.1.3 Deflect the second pipe section in any direction an amount equal to the distance specified in Table 2 of this standard. Firmly restrain pipe section two.

10.3.1.4 Plug the outbound pipe ends. Fill the assembly with water expelling all air. Gradually apply the 4.3 psi internal hydrostatic pressure and maintain for 15 min.

10.3.2 *Shear Loading Resistance (Type B Couplings Only)*—The joint shall have sufficient resistance to shear loading to meet the requirements of the following test.

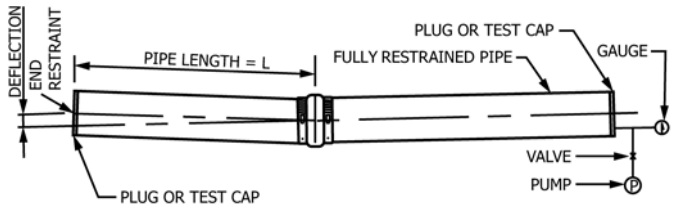
10.3.2.1 Support two joined lengths of randomly selected pipe on blocks, a minimum of 1 ½ in. (38.1 mm) high, at three locations. One length shall be a minimum of 24 in. (609.6 mm) in length, supported on blocks, one near the uncoupled end, and the other immediately adjacent to the coupling. Firmly restrain this length in position as shown in Fig. 2. The other coupled length shall be a minimum of 5 ft (1.52 m) in length and supported by a single block 6 in. (152.4 mm) from the end of the pipe.

10.3.2.2 Fill the assembly with water and expel all air. Apply a load of 50 lb per in. (22.7 kg) of nominal diameter at a point 6 in. (152.4 mm) from the edge of the coupling upon a 12 in. (304.8 mm) length of 3 by 3 in. (76.2 by 76.2 mm) angle iron or load distribution pad located on the top of the pipe immediately adjacent to the coupling of the pipe having one

TABLE 2 Requirements—Deflection per Foot of Pipe Length[A]

Nominal ID, in. (mm)	Deflection in./linear ft (mm/linear m)
2–12 (50–300)	½ (42)
15–24 (375–600)	⅜ (31)
27–36 (675–900)	¼ (21)
39–42 (975–1050)	3⁄16 (15)

[A] See 10.3.1.



NOTE 1—Deflection (in.(mm)) = L(ft(m)) × offset (in./linear ft (mm/linear m)). See Table 2.

FIG. 1 Deflection Test

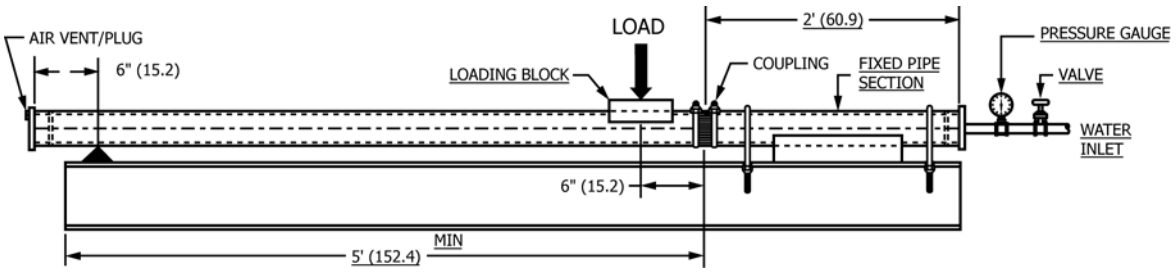


FIG. 2 Shear Test

support only. Under this loading there shall be no visible leakage or displacement of more than 3/8 in. (9.53 mm) from true alignment adjacent to the coupling, when an internal pressure equivalent to a 10 ft (3.05 m) head of water 4.3 psi (29.6 kPa) is applied. Maintain the load and internal pressure for 15 min.

11. Certification

11.1 When specified in the purchase order or contract, the purchaser shall be furnished certification stating samples representing each lot have been tested and inspected as indicated 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. Product Marking

12.1 Each coupling shall be marked with the manufacturers name or trademark, or both.

12.2 The type and size of pipe for which the coupling is intended or the manufacturer's product number shall be marked on or attached to each coupling.

13. Keywords

13.1 couplings; drainage; elastomeric; flexible; sewer; transition; underground piping