



# Standard Specification for Flexible Transition Couplings for Underground Piping Systems<sup>1</sup>

This standard is issued under the fixed designation C 1173; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 These specifications describe 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 or inserts and that meet 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 shall be regarded as 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:

C 717 Terminology of Building Seals and Sealants<sup>2</sup>

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension<sup>3</sup>

D 471 Test Method for Rubber Property—Effect of Liquids<sup>3</sup>

D 518 Test Method for Rubber Deterioration—Surface Cracking<sup>3</sup>

D 543 Practice for Evaluating Resistance of Plastics to Chemical Reagents<sup>4</sup>

D 573 Test Method for Rubber—Deterioration in an Air Oven<sup>3</sup>

D 638 Test Method for Tensile Properties of Plastics<sup>4</sup>

D 1149 Test Method for Rubber Deterioration Surface Ozone Cracking in a Chamber<sup>3</sup>

D 2240 Test Method for Rubber Property—Durometer Hardness<sup>3</sup>

D 3045 Practice for Heat Aging of Plastics Without Load<sup>5</sup>

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology C 717.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *center stop*—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 *fitting*—parts of a pipeline other than the straight pipe couplings, or valves.

3.2.3 *flexible transition couplings*—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.

3.2.4 *free torque*—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.

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

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

3.2.7 *lot*—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.

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

3.2.9 *shear ring*—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

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 09.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 08.02.

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 sleeve incorporating corrosion resistance tension bands and a tightening mechanism. Couplings shall be fabricated with or without shear rings, and with or without a center stop.

4.1.2 *Type B*—A coupling consisting of an elastomeric or rubber sleeve incorporating a corrosion resistant outer sleeve and tension bands, or tightening mechanism, or both (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 set forth in Table 1.

5.2 Stainless steel tension bands shall be of the 300 series stainless steel.

5.3 Couplings or bushings/inserts, or both, of multi-piece construction or with splices shall show no separation, peeling, or other defects when tested in accordance with Section 9.

5.4 The coupling 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.

## 6. Requirements

6.1 The physical and chemical properties of the coupling materials shall conform to the requirements specified in Table 1.

## 7. Dimensions

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

## 8. Sampling, Tests, and Retests

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

8.2 No less than two couplings for each size or type shall be tested, unless otherwise specified or waived by the purchaser.

8.3 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.

## 9. Test Methods

### 9.1 Elastomeric Materials:

9.1.1 *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 D 2240.

9.1.2 *Tensile Strength and Elongation*— The dumbbells shall be prepared from sections of the finished material. See Test Methods D 412.

9.1.3 *Heat Aging*, for hardness, tensile and elongation shall be performed in accordance with Test Method D 573. Specimens shall be oven-aged for 96 h at  $158 \pm 3.6^\circ\text{F}$  ( $70 \pm 2^\circ\text{C}$ ).

9.1.4 *Ozone Resistance*—Test specimens shall be used as described in Test Method D 518, Procedure A, stretched 20 % and exposed to an ozone concentration of 50 parts per 100 million for 100 h at  $104 \pm 3.6^\circ\text{F}$  ( $40 \pm 2^\circ\text{C}$ ). See Test Method D 1149.

9.1.5 *Water Absorption*—Size and time determinations shall be set in accordance with Test Method D 471. A specimen 0.075 by 1 by 2 in. (1.9 by 25 by 50 mm) shall be immersed in distilled water at  $158 \pm 3.6^\circ\text{F}$  ( $70 \pm 2^\circ\text{C}$ ) 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.

9.1.6 *Chemical Resistance*—Samples shall be aged for 48 h at  $74 \pm 3.6^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) using solutions of 1N sulfuric acid and 1N hydrochloric acid. See Test Method D 543.

### 9.2 Tension Band Performance:

9.2.1 *Torque Resistance*—Stainless steel tension bands shall be tested to withstand the manufacturers required torque or a minimum of 60 in.-lb (8.5 Nm) of applied torque without

**TABLE 1 Test Requirements**

Properties	Physical Requirements	ASTM Test Method
<b>Elastomeric Materials</b>		
Hardness, Nominal Shore "A" Durometer as specified by the coupling manufacturer	50–75	D 2240
Hardness, Nominal Shore "D" Durometer as specified by the coupling manufacturer	35–45	D 2240
Tensile strength, min psi (KPa)	1000 (6894)	D 412, Die C, Fig. 2 or D638
Elongation at rupture, min, %	200	D 412, Die C, Fig. 2 or D638
Heat aging, 70 h, $158 \pm 3.6^\circ\text{F}$ ( $70 \pm 2^\circ\text{C}$ )		D 573 or D3045
Hardness increase, maximum Durometer points	10	
Change in tensile strength, max, %	25	
Change in elongation, max, %	35	
Ozone resistance	No cracks	D 1149
At 20 % elongation		
For 100 h at $104 \pm 3.6^\circ\text{F}$ ( $40 \pm 2^\circ\text{C}$ )		
With 50 parts per 100 million		
Water absorption, weight gain, %, max	20	D 471
Chemical resistance, 48 h, $74 \pm 3.6^\circ\text{F}$ ( $23 \pm 2^\circ\text{C}$ )	no weight loss	D 543
<b>Stainless Steel Materials</b>		
Torque resistance, 60 in.-lb (6.8 Nm)	no failure	9.2 of C1173
Manufacturers required torque resistance	no failure	9.2 of C1173
<b>Joint Assemblies</b>		
Deflection resistance 4.3 psi (30 kPa)	as given in Table 2	9.3.1 of C1173
Shear loading resistance (optional)	as given in Table 3	9.3.2 of C1173

visible signs of failure. The band shall be tested over a steel mandrel of the appropriate coupling diameter and torqued as required.

9.2.2 The maximum free running torque shall be 4 in.-lb (0.45 Nm).

9.2.2.1 Stainless steel tension bands with torque resistance in excess of 100 in.-lb shall have a maximum free running torque of 8 in.-lb.

9.2.3 Test Procedure for Free Running Torque:

9.2.3.1 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.

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

9.3 Joint Assemblies:

9.3.1 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). 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.

9.3.2 Shear Loading Resistance—The joint shall have sufficient resistance to shear loading to meet the requirements of the following test. Two lengths of pipe shall be joined by a coupling with the two joined lengths of pipe supported on blocks at three locations. One length of pipe shall be supported on two blocks, one near the unjoined end, and the other immediately adjacent to the joint. This length shall then be firmly restrained in position. The other length of pipe shall be supported by a single block located 36 in. (0.9 m) from the centerline of the joint. A load of 50 lb/in. (220N/25 mm) of nominal pipe diameter adjusted by the weight of pipe extending beyond the support times its moment arm divided by the moment arm to the test load, shall be uniformly applied over an arc of 120° and along a longitudinal length of 24 in. (0.6 m) immediately adjacent to the joint of the pipe having one support (see Fig. 2). While thus loaded, an internal hydrostatic pressure of 4.3 psi (30 KPa) shall be maintained for a period of 1 h with the temperature of water, pipe, and atmosphere within the range between 60 and 75°F (15.5 and 23.8°C) (Note 2).

NOTE 2—Fig. 2 and Table 3 in 9.3.1 are not mandatory at this time because Subcommittee C24.75 is attempting to verify the procedure and values.

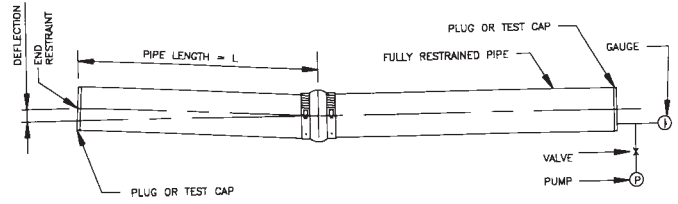
10. Certification

10.1 When specified in the purchase order or contract, the purchaser shall be furnished certification stating samples rep-

TABLE 2 Requirements—Deflection per Foot of Pipe Length<sup>A</sup>

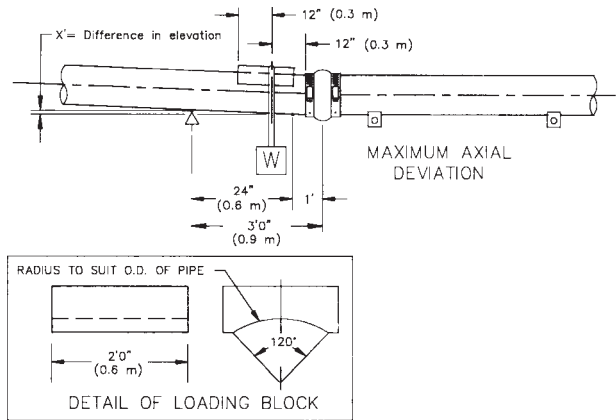
Nominal ID, in. (mm), incl.	Offset in./linear ft (mm/linear m)
2–12 (50–300)	1/2 (42)
15–24 (375–600)	3/8 (31)
27–36 (675–900)	1/4 (21)
39–42 (975–1050)	3/16 (15)

<sup>A</sup> See 9.3.1.



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

FIG. 1 Deflection Test (Plan View)



W = 59 LB. PER IN. (220 N PER 25mm)

$$AXIAL DEVIATION = \frac{3X'}{2}$$

NOTE 1—For maximum axial deviation values, see Table 3.

FIG. 2 Shear Test

TABLE 3 Maximum Axial Deviation<sup>A</sup>

Nominal ID, in. (mm), incl.	Axial Deflection, in. (mm)
2–6 (50–150)	3/8 (9)
8–12 (200–300)	7/8 (22)
15–24 (375–600)	1 1/8 (28)
27–36 (675–900)	3/4 (19)
39–42 (975–1050)	9/16 (14)

<sup>A</sup> See 9.3.2.

resenting 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.

11. Product Marking

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

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

11.3 All couplings shall be marked with the designation ASTM C 1173 showing compliance to this standard.

12. Keywords

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

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