Designation: F2176 – 17

An American National Standard

Standard Specification for Mechanical Couplings Used on Polyethylene Conduit, Duct and Innerduct[1]

This standard is issued under the fixed designation F2176; 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 establishes requirements for material, performance, workmanship and test methods for the qualification of 2 in. and smaller mechanical couplings that connect to SDR 13.5, DR 15.5, Schedule 40 and Schedule 80 polyethylene conduit, duct and innerduct covered by Specification F2160. Throughout this standard, "conduit" refers to "conduit, duct or innerduct" manufactured in accordance with Specification F2160.

NOTE 1—F2176 fittings are not applicable to True-sized and ID-controlled conduit per F2160.

1.2 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.

1.3 The couplings covered by this specification are typically designed to join between conduit ends (in-line coupling). The same coupling-to-conduit joint design may be used as a part of other coupling joint designs that telescope, or connect to bulkheads, or other adapter fitting designs. The requirements of this standard apply only to the coupling-to-conduit joint design. The performance requirements of other coupling joint designs are not a part of this standard.

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 9 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D638 Test Method for Tensile Properties of Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

F412 Terminology Relating to Plastic Piping Systems

F2160 Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

3. Terminology

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

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *coupling joint, n*—the connection between the coupling and a conduit end.

3.2.2 *duct, n*—a conduit (see Terminology F412, *conduit*).

3.2.3 *inline mechanical couplings, n*—a device used to join two conduit ends.

3.2.4 *innerduct, n*—a conduit installed inside a conduit.

4. Materials and Manufacture

4.1 The physical properties of each material used to produce mechanical couplings shall be available from the coupling manufacturer upon request.

4.2 Specifications outlining all the physical properties and effects of environmental conditions for materials of manufacture shall be available from the coupling manufacturer upon request.

NOTE 2—Materials should have a demonstrated resistance to environmental stress cracking when exposed, under stress, to chemical compounds encountered in or external to conduit systems and a demonstrated resistance to bacteriological decomposition. Such compounds include, but

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.10 on Fittings.

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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.

*A Summary of Changes section appears at the end of this standard

are not limited to, alkalines, fertilizers, ice thawing chemicals, insecticides, herbicides, and acids.

5. Performance Requirements

5.1 The following requirements shall be met on each coupling design and nominal size. Any revisions by the manufacturer to the original coupling design after the initial qualification testing requires retesting to ensure conformance with these requirements. All coupling/conduit joint assemblies shall be prepared in accordance with 8.2.

NOTE 3—It is permissible when accomplishing these tests to do so on only the thickest and thinnest (lowest and highest DR) conduit wall sections in Specification F2160 that the coupling is to be used on. If in those tests all performance requirements are met, all wall thicknesses between those tested may be considered as having met the requirements.

5.2 *Pressure Requirements:*

5.2.1 *Sustained Internal Pressure*—The coupling/conduit joint assemblies shall not fail by leakage as described by and tested in accordance with 9.1.

5.2.2 *Sustained External Pressure*—The coupling/conduit joint assemblies shall not fail by leakage as described by and tested in accordance with 9.2.

5.3 *Tensile Strength Requirements :*

5.3.1 *Pullout Resistance*—The coupling/conduit joint assemblies shall comply with tensile loading requirements in Table 1 when tested in accordance with 9.3.

NOTE 4—Minimum pullout resistance's in Table 1 were derived by the following formula. Double the requirements for constant tensile load in Table 2.

5.4 *Constant Tensile Load*—The joint or coupling shall not fail by pullout when loaded to axial tensile load requirements in Table 2 and tested in accordance with 9.4.

NOTE 5—The constant tensile load test is intended to demonstrate that a joint in the conduit system is resistant to the effects of long term creep that may result from temperature changes and other forces after installation. Load values in Table 2 were derived by the following methodology. Nominal modulus of elasticity of high density polyethylene (113 000 psi) × coefficient of thermal expansion (0.00011 in./in./F°) × 50°F (10°C) temperature change × average area of DR11 conduit wall.

5.5 *Impact Resistance*—Coupling specimens, not as part of assemblies, shall not fail as defined by and tested in accordance with 9.5.

6. Dimensions

6.1 The manufacturer, upon request of the user shall furnish critical dimensions and tolerances of his couplings.

NOTE 6—Because of the varied fitting designs of couplings available for use on PE conduit a table of dimensions would be meaningless and without value and is therefore omitted from this standard.

7. Workmanship, Finish, and Appearance

7.1 The manufacture of these couplings shall be in accordance with good commercial practice, uniform in color and free of visual defects such as burrs, cracks, holes, foreign materials or voids so as to produce fittings meeting the requirements of this standard.

TABLE 1 Mechanical Joint Pullout Resistance

Nominal Conduit Size	Minimum Pullout Resistance
¾ IPS	380 lbs (172 kg)
1 IPS	760 lbs (345 kg)
1¼ IPS	940 lbs (426 kg)
1½ IPS	1220 lbs (553 kg)
2 IPS	1920 lbs (871 kg)

TABLE 2 Mechanical Joint Constant Load Resistance

Nominal Conduit Size	Minimum Pullout Resistance
¾ IPS	190 lbs (86.2 kg)
1 IPS	380 lbs (172.4 kg)
1¼ IPS	470 lbs (213.2 kg)
1½ IPS	610 lbs (276.7 kg)
2 IPS	960 lbs (435.5 kg)

8. Specimen Preparation

8.1 *Conditioning:*

8.1.1 Unless otherwise specified, condition the specimens (coupling and conduit) at the standard laboratory temperature of 73.4 ± 3.6°F (23 ± 2°C) for not less than 16 h before assembly.

8.2 *Preparation of Specimens for Testing:*

8.2.1 Prepare test specimens so that the minimum free length of conduit from a joint being tested is not less than five times the conduit diameter. It is permissible to test multiple couplings together provided they are separated by a minimum distance equal to five times the conduit diameter.

8.2.2 Test joints shall be assembled on the appropriate size conduit in accordance with the fitting manufacturer's joining procedure. For referee testing, conduit shall be straight with no scratches or gouges.

8.2.3 Condition assembled test specimens a minimum of 2 h at the test temperature to be used after being assembled before initiating test procedure.

NOTE 7—The additional conditioning time following assembly of typical fitting designs used for conduit joining provides more consistent test results.

8.3 *Test Conditions*—Testing shall be conducted at the standard laboratory temperature of 73.4 ± 3.6°F (23 ± 2°C) unless otherwise specified.

9. Test Methods

9.1 *Sustained Internal Pressure Test:*

9.1.1 Test six joints assembled in accordance with 8.2. Pressurize specimens with air to 150 ± 2 psig (1030 ± 10 kPa) and hold at pressure while top of fitting is submerged in water at a depth of 6.00 ± 0.50 in. (152.4 ± 12.7 mm) for one hour. Then, visually monitor the specimens. The coupling shall not fail by leaking as defined by visual bubbles coming from the coupling/conduit interface at a rate greater than one bubble per second.

NOTE 8—**Warning:** Pressure testing with air at the pressures in 9.1.1 can be hazardous in the event of a catastrophic failure of the test specimen. Specimens under pressure should be observed through a transparent shield or other means to assure the safety of the observers.

9.1.2 Failure of two of the six specimens shall constitute failure of the test. Failure of one of the six specimens tested is cause for retest of six additional specimens. Failure of one of the six specimens in the re-test shall constitute failure of the test.