



Standard Test Methods for Physical Properties of Smooth-Wall, Coilable, Polyethylene (PE) Conduit (Duct) for Preassembled Wire and Cable¹

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1. Scope

1.1 These test methods cover procedures for determining the environmental performance properties of smooth-wall, coilable, medium-density and high-density polyethylene (MDPE and HDPE) conduit (duct) for preassembled wire and cable.

1.2 Whenever two sets of values are presented, in different units, the values in the first set are the standard, while those in parentheses are for information only.

1.3 *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 2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)²

3. Significance and Use

3.1 Environmental performance test values for smooth-wall, coilable, medium density and high density polyethylene (MDPE and HDPE) conduit (duct) for preassembled wire and cable may provide data for research and development, engineering design, quality control, and acceptance or rejection under specifications.

4. Procedure

4.1 *Performance Tests*—Remove electrical wire or cables, or both, from the duct before performing the following tests.

4.2 *Compression and Recovery*—Flatten three specimens of duct 6 in. (150 mm) long, that have been conditioned at $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$) and $50 \pm 5\%$ relative humidity for not less

than 48 h, between parallel plates at a rate of 0.5 in./min (13 mm/min) in a suitable press until the distance between the parallel plates has been decreased by 50 % of the original inside diameter of the duct. Be sure the specimens, the test apparatus, and the surrounding air are in thermal equilibrium with one another at a temperature of $23 \pm 2^\circ\text{C}$ during the test. The minimum force required to compress the specimens to the 50 % deflection is shown in Table 1. Within 10 min after removal of the force, the specimens shall recover as specified in the individual product specification.

4.3 Impact Test:

4.3.1 *Room-Temperature Test*—Cut ten 6-in. (150-mm) specimens, from finished lengths of each size of coilable PE duct to be tested. The surfaces shall not have cracks, tears, or other imperfections. The specimens, the test apparatus, and the surrounding air are to be in thermal equilibrium with one another at a temperature of $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$) during the test. Use the test apparatus and method described in 4.3.3.

4.3.2 *Low-Temperature Test*—Cut ten 6-in. (150-mm) specimens, from finished lengths of each size of coilable PE duct to be tested. The surfaces shall not have cracks, tears, or other imperfections. Condition the specimens at a temperature of $-20 \pm 2^\circ\text{C}$ ($-4 \pm 4^\circ\text{F}$) for 5 h. Condition the test apparatus at a temperature of $23 \pm 2^\circ\text{C}$ ($73 \pm 4^\circ\text{F}$). The test apparatus and method are described in 4.3.3. Remove the samples from the cold chamber and complete the impact test within 30 s.

4.3.3 *Test Method*—Test each specimen separately while it is resting on a solid, flat steel plate that has a nominal thickness of at least 0.5 in. (12.5 mm) and that is firmly anchored with its upper surface horizontal. It is recommended that a protective cage surround the plates and specimens to prevent injury from pieces of broken duct in the event that the duct shatters. Allow a 20-lb (9-kg) Type B tup as described in Test Method D 2444 to fall freely through a vertical guide from the heights indicated in Table 2. Allow the face of the tup to strike the center of the specimen once (provide for preventing the tup from striking the specimen more than once). A crack or tear longer than 0.031 in. (0.8 mm) is considered a failure.

¹ These test methods are under the jurisdiction of ASTM Committee D09 on Electrical and Electronic Insulating Materials and are the direct responsibility of Subcommittee D09.18 on Solid Insulations, Non-Metallic Shieldings and Coverings for Electrical and Telecommunication Wires and Cables.

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² *Annual Book of ASTM Standards*, Vol 08.04.

TABLE 1 Minimum Load for Compression and Recovery Test

Nominal Inside Diameter, in. (mm)		Type II Medium Density		Type III High Density	
		lb/ft	kN/m	lb/ft	kN/m
1/2	(12.7)	250	3.6	300	4.4
3/4	(19.3)	250	3.6	300	4.4
1	(25.4)	275	4.0	350	5.1
1 1/4	(31.8)	300	4.4	375	5.5
1 1/2	(38.1)	375	5.5	475	6.9
2	(50.8)	500	7.3	600	8.8
2 1/2	(63.5)	700	10.2	700	10.2
3	(76.2)	700	10.2	700	10.2

TABLE 2 Height for Dropping Tup

Nominal Inside Diameter, in. (mm)		Type II Medium Density		Type III High Density	
		ft	m	ft	m
1/2	(12.7)	4	1.2	2.5	0.8
3/4	(19.3)	4	1.2	4	1.2
1	(25.4)	5	1.5	5	1.5
1 1/4	(31.8)	6	1.8	6	1.8
1 1/2	(38.1)	7.5	2.3	7.5	2.3
2	(50.8)	9.5	2.9	9.5	2.9
2 1/2	(63.5)	10.5	3.2	10.5	3.2
3	(76.2)	11	3.4	11	3.4

5. Precision and Bias

5.1 *Precision*—These test methods have been in use for many years, but no statements of precision have been made and no activity is planned to develop such a statement.

5.2 *Bias*—A statement of bias is not possible due to a lack of a standard reference material.

6. Keywords

6.1 compression and recovery; conduit; duct; high-density polyethylene; impact test; medium-density polyethylene

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