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AMERICAN SOCIETY FOR TESTING AND MATERIALS  
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# Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastics Utilities Conduit and Fittings<sup>1</sup>

This standard is issued under the fixed designation D 2750; 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 This specification covers the requirements for acrylonitrile-butadiene-styrene (ABS) plastic conduit produced by single extrusion or simultaneous multiple coextrusion and fittings used for communication and electrical wires and cables installed underground for public utilities. Installation procedures are given in the appendix.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.3 The following precautionary caveat pertains only to the test method portion, Section 9, of this specification: *This standard does not purport to address all of the safety problems, 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 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing<sup>2</sup>

D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure<sup>3</sup>

D 1600 Terminology for Abbreviated Terms Relating to Plastics<sup>2,3</sup>

D 1788 Specification for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Plastics<sup>3,4</sup>

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings<sup>3</sup>

D 2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings<sup>3</sup>

D 2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading<sup>3</sup>

D 2444 Test Method for Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)<sup>3</sup>

F 412 Terminology Relating to Plastic Piping Systems<sup>3</sup>

### 2.2 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>5</sup>

2.3 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage<sup>5</sup>

## 3. Terminology

3.1 Definitions are in accordance with Terminology F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise specified. The abbreviation for acrylonitrile-butadiene-styrene is ABS.

3.1.1 *acrylonitrile-butadiene-styrene (ABS) pipe and fittings plastics*—plastics containing polymers or blends of polymers, or both, in which the minimum butadiene content is 6 %, the minimum acrylonitrile content is 15 %, the minimum styrene or substituted styrene content, or both, is 15 %, and the maximum content of other monomers is 5 % and lubricants, stabilizers, and colorants.

## 4. Classification

4.1 This specification covers two types of plastic conduit for use by public utilities, designated as follows:

4.1.1 *Type I (also known as Type EB (Encased Burial))*, designed to be encased in concrete.

4.1.2 *Type II (also known as Type DB (Direct Burial))*, designed for installation without encasement in concrete.

4.2 Plastic conduit produced by simultaneous multiple coextrusion shall be identified "CoeX."

NOTE 1—Type I (EB) and Type II (DB) can be produced by single extrusion or simultaneous multiple coextrusion.

## 5. Requirements

5.1 *Materials*—The conduit and fittings shall be manufactured from a virgin ABS compound, having a minimum cell classification 2-2-2, and may contain lubricants, dyes, pigments, and stabilizers (maximum 3), and as defined in Specification D 1788 from a single raw material supplier. Clean reground material from the manufacturer's own pipe products may be used by the same manufacturer provided the end product meets the requirements of this specification.

NOTE 2—Fittings described in this specification are intended for use with either pipe classification.

5.2 *Workmanship*—The conduit shall be homogeneous throughout and free from visible cracks, holes, foreign

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.66 on Conduit.


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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 08.04.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 08.02.

<sup>5</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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inclusions, or other defects. The conduit shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

5.3 *Dimensions*—The dimensions and tolerances of the conduit shall be as specified in Table 1. The dimensions and types of fittings shall be as specified in Tables 2 through 8. The fittings shall be capable of being solvent welded and of freely passing a mandrel  $\frac{1}{4}$  in. (6.4 mm) less in diameter than the nominal bore of the conduit. The dimensions of radius of curvature shall be as specified in Table 9. The dimensions shall be measured in accordance with 9.1.

5.3.1 *Length*—Conduit shall be supplied in lengths of 20 or 25 ft (6.1 or 7.6 m), or as otherwise agreed upon between the purchaser and the supplier. A length shall be considered to be the overall length of the conduit, including the integral bell, or the coupling if attached, unless otherwise specified. The tolerance on lengths shall be  $\pm 1$  in. ( $\pm 25$  mm).

5.3.2 *Thickness of Outer Layer*—For pipe produced by simultaneous multiple coextrusion, that is, pipe containing two or more concentric layers, the outer layer shall be at least 0.020 in. (0.51 mm) thick.

5.3.3 *Bond*—For pipe produced by simultaneous multiple coextrusion, the bond between the layers shall be strong and uniform, it shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly at any point, nor shall separation of bond occur, between layers, during testing performed under the requirements of this specification.

5.4 *Fittings Quality*—Five specimens shall be tested in accordance with 9.2. The average value at failure shall not be less than the values given in Table 10.

5.5 *Impact Resistance*—The minimum drop weight impact values for conduit shall be as listed in Table 11 when tested in accordance with 9.3.

NOTE 3—This test is intended for use only as a quality control test, not for use as a simulated service test.

5.6 *Pipe Stiffness*—When tested in accordance with Test Method D 2412, the minimum pipe stiffness at 5 % deflection shall be 15 lbf/in. · in. (103 kPa) for Type I conduit or 60 lbf/in. · in. (414 kPa) for Type II conduit.

NOTE 4—The 5 % deflection criterion, which was arbitrarily selected for testing convenience, should not be considered as a limitation with respect to in-use deflection. The engineer is responsible for establishing the acceptable deflection limit.

5.7 *Water Absorption*—The conduit or fittings shall not increase in weight more than 0.60 % when immersed in water and tested as specified in 9.4.

5.8 *Chemical Resistance*—The conduit or fittings shall not increase in weight more than 0.60 % when immersed in selected chemicals in accordance with 9.5.

5.9 *Joint Tightness*—When joined by solvent cementing or other suitable methods, the joints shall be watertight, and shall not leak when tested at an internal pressure of 25 psi (170 kPa) as specified in 9.6. All solvent cemented joints shall be made in accordance with to the recommendations of the conduit manufacturers, using cements meeting the requirements of Specification D 2235.

conformance with this specification shall be taken at random from each lot. It is recommended that a sampling plan, agreed upon between the purchaser and the supplier, be employed.

## 7. Specimen Preparation

7.1 Test specimens shall be cleanly cut from conduit samples to conform to the requirements of the test methods in such a manner as to be free from nicks, burrs, or other marks that would impair the test results.

## 8. Conditioning

8.1 *Conditioning*—Condition the test specimens prior to test at  $73.4 \pm 3.6^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity for not less than 40 h in accordance with Procedure A of Methods D 618 for those tests where conditioning is required.

8.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of  $73.4 \pm 3.6^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity unless otherwise specified.

## 9. Test Methods

9.1 *Dimensions*—Measure outside diameter, wall thickness, and length on a minimum of three samples of each lot. Make a minimum of six readings on each sample for outside diameter and wall thickness in accordance with Test Method D 2122.

9.2 *Fittings Quality*—Cut five 1-in. (25-mm) specimens from the fittings sockets or the bell ends of the pipe. Crush each at a cross-head speed of 0.50 in. (12.5 mm)/min, with the bond line horizontal. Record the load at failure. Failure is defined as:

9.2.1 A white stress line shows across bond line,

9.2.2 Specimens start to show evidence of buckling, or

9.2.3 Bond line breaks.

9.3 *Impact Resistance*—Impact five specimens of conduit, not less than 6 in. (150 mm) in length and cleanly cut, at the levels specified in Table 11. The impact test is to be conducted in accordance with Test Method D 2444, using a Tup B and Holder B.

9.3.1 None of the five specimens tested shall fail; if one fails, test a further five specimens, all shall pass; nine passes out of ten specimens tested shall be acceptable. When testing at  $32^\circ\text{F}$  ( $0^\circ\text{C}$ ), the specimens shall be conditioned for at least 30 min in liquid or 3 h in air at  $32$  to  $35^\circ\text{F}$  ( $0$  to  $1.6^\circ\text{C}$ ).

9.3.2 Failure is defined as any visible crack in the conduit on either inside or outside surface.

9.4 *Water Absorption*—Immerse three conduit specimens,  $6 \pm \frac{1}{8}$  in. ( $150 \pm 5$  mm) in length and cleanly cut or three complete fittings in water at  $23 \pm 2^\circ\text{C}$  for 48 h. Remove the specimens, wipe dry with a clean dry cloth, and reweigh immediately. Calculate the average percent gain in weight on the basis of the initial weight.

9.5 *Chemical Resistance*—Determine the resistance to the following chemicals, using samples of cleanly cut, 12-in. (300-mm) long conduit:

Chemical	Concentration in Water Solution
Sodium carbonate	0.1 N
Sodium sulfate	0.1 N
Sodium chloride	5 %
Sulfuric acid	0.1 N

## 6. Sampling

6.1 Samples of conduit and fittings sufficient to determine

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Chemical	Concentration in Water Solution
Hydrochloric acid	0.2 N
Sodium hydroxide	0.2 N
Acetic acid	5 %

nated in the specification shall be followed. If, upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

9.5.1 Test three specimens with each reagent.  
 9.5.2 Weigh the specimens to the nearest 0.1 g and completely immerse in the chemical for  $72 \pm 1$  h. Remove, rinse with tap water, and wipe with a clean dry cloth. Condition specimens at 23°C and 50 % relative humidity for 2, -0, +¼ h and reweigh.

9.5.3 Calculate the change in weight to the nearest 0.01 % on the basis of the initial weight.

9.6 *Joint Tightness*—Join two pieces of conduit, approximately 15 in. (375 mm) long, with a fitting by solvent cementing, or other method recommended by the manufacturer, and allow to stand for 12 h. Following the procedure used in Test Method D 1598, subject the specimen to an internal pressure of 25 psi (170 kPa) for a minimum of 12 h. At the end of this period, examine the conduit and joints for signs of leakage.

**10. Retest and Rejection**

10.1 If the results of any test(s) do not meet the requirements of this specification, the test(s) may be conducted again in accordance with an agreement between the purchaser and the seller. There shall be no agreement to lower the minimum requirement of the specification by such means as omitting tests that are a part of the specification, substituting or modifying a test method, or by changing the specification limits. In retesting, the product requirements of this specification shall be met, and the test methods desig-

**11. Certification**

11.1 A manufacturer shall provide certification that the product was manufactured in accordance with the requirements of this specification signed by an authorized agent, providing that the user, purchaser, or specifying agency, or combination thereof, so request in the purchase order or contract. Furthermore, when agreed upon between the manufacturer and the user, purchaser, or specifying agency, or combination thereof, and preferably prior to the date of manufacture, the manufacturer shall provide test data and the date on which tests were conducted for a specific lot or shipment of product made under this specification.

**12. Packaging and Marking**

12.1 *Packaging*—The conduit shall be bundled, packed, or racked in packages so constructed as to ensure acceptance by common or other carriers at the lowest rate to the point of delivery unless otherwise specified in the contract or order.

12.2 *Marking*—Each length of conduit shall be identified with a marking showing the manufacturer's name or trademark, or both, ABS, nominal size, control number, or date of manufacture, Type I or II, ABS cell classification, and this designation "ASTM D 2750" including the year of issue with which the conduit complies. Conduit produced by simultaneous multiple coextrusion shall be marked "CoeX" in accordance with 3.2. No order of marking is specified.

12.2.1 Any additional information deemed necessary by

**TABLE 1 Conduit Dimensions and Tolerances, in. (mm)**

Nominal Size	Average OD	Tolerance on		Minimum Wall Thickness <sup>A</sup>	
		Average	Out-of-Round	Type I	Type II
1	1.315 (33.40)	±0.005 (±0.13)	±0.015 (±0.38)		0.060 (1.52)
1½	1.900 (48.26)	±0.006 (±0.15)	±0.030 (±0.76)		0.060 (1.52)
2	2.375 (60.32)	±0.006 (±0.15)	±0.030 (±0.76)	0.060 (1.52)	0.068 (1.73)
3	3.500 (88.90)	±0.008 (±0.20)	±0.030 (±0.76)	0.063 (1.60)	0.105 (2.67)
3½	4.000 (101.60)	±0.008 (±0.20)	±0.050 (±1.27)	0.074 (1.88)	0.121 (3.07)
4	4.500 (114.30)	±0.009 (±0.23)	±0.050 (±1.27)	0.084 (2.13)	0.138 (3.51)
5	5.563 (141.30)	±0.010 (±0.25)	±0.050 (±1.27)	0.107 (2.72)	0.172 (4.37)
6	6.625 (168.28)	±0.011 (±0.28)	±0.050 (±1.27)	0.129 (3.28)	0.205 (5.21)

<sup>A</sup> The tolerance on wall thickness is 0.020 in. (0.51 mm) or 12 %, whichever is the greatest. Note the tolerance is all on the positive side of the minimum requirement.

**TABLE 2 Types of Conduit Fittings**

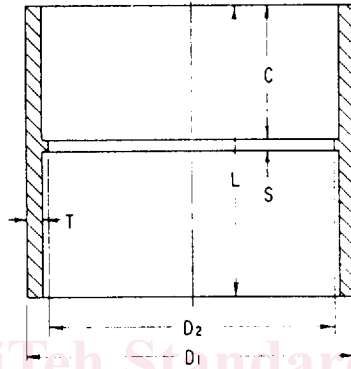
Type	Nominal Sizes, in.	
Couplings	1, 1½, 2, 3, 3½, 4, 5, 6	
Caps		
Elbows, 45 deg and 90 deg		
Long-sweep bends, 45 deg and 90 deg		
S-Bends		
Bell ends		
Curved segments, 22½ deg		
Adapters to G. C., F. C., or A.C.C.		
Clay conduit adapters		3½
Reducers		3 × 2, 3½ × 2, 3½ × 3, 4 × 3, 4 × 3½, 5 × 4, 6 × 5

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**TABLE 3 Socket Diameters, in. (mm)**

Nominal Size	Average at Entrance	Average at Bottom	Tolerance on Average	Out-of-Round Tolerance
1	1.330 (33.78)	1.310 (33.27)	±0.005 (±0.13)	±0.010 (±0.25)
1½	1.918 (48.72)	1.894 (48.11)	±0.006 (±0.15)	±0.012 (±0.31)
2	2.393 (60.78)	2.369 (60.17)	±0.006 (±0.15)	±0.012 (±0.31)
3	3.515 (89.28)	3.492 (88.70)	±0.008 (±0.20)	±0.015 (±0.38)
3½	4.015 (101.98)	3.992 (101.40)	±0.008 (±0.20)	±0.015 (±0.38)
4	4.515 (114.68)	4.491 (114.07)	±0.009 (±0.23)	±0.015 (±0.38)
5	5.593 (142.06)	5.533 (140.54)	±0.010 (±0.25)	±0.020 (±0.51)
6	6.625 (168.28)	6.614 (168.00)	±0.010 (±0.25)	±0.030 (±0.76)

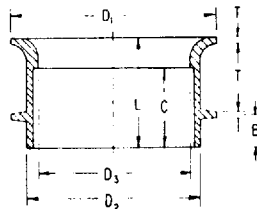
**TABLE 4 Couplings**



**Average Dimensions, in. (mm)**

Nominal Size	$D_1$	$D_2$	L	C	S	T
1	1.475 (37.46)	1.195 (30.35)	2½/32 (51.59)	0.97 (24.64)	0.090 (2.29)	0.070 (1.78)
1½	2.105 (53.47)	1.780 (45.21)	29/32 (57.94)	1.09 (27.69)	0.100 (2.54)	0.090 (2.29)
2	2.620 (66.55)	2.255 (57.28)	27/16 (61.91)	1.16 (29.46)	0.110 (2.79)	0.110 (2.79)
3	3.780 (96.01)	3.350 (85.09)	3¾ (85.72)	1.63 (41.40)	0.120 (3.05)	0.125 (3.18)
3½	4.310 (109.47)	3.840 (97.54)	3¾/16 (90.49)	1.72 (43.69)	0.120 (3.05)	0.140 (3.56)
4	4.855 (123.32)	4.310 (109.47)	31/16 (93.66)	1.78 (45.21)	0.120 (3.05)	0.160 (4.06)
5	5.965 (151.51)	5.363 (136.22)	43/32 (103.98)	1.97 (50.04)	0.160 (4.06)	0.180 (4.57)
6	7.050 (179.67)	6.375 (161.92)	415/32 (113.51)	2.16 (54.86)	0.160 (4.06)	0.190 (4.83)
Tolerances	±0.020 (±0.51)	+0.020 (+0.51)	±1/32 (±0.79)	±0.020 (±0.51)	±0.020 (±0.51)	+0.020 (+0.51)

**TABLE 5 Bell Ends**



**Average Dimensions and Tolerances, in. (mm)**

Nominal Size	$D_1$	$D_2$	$D_3$	B	C	L	T
1	1.82 (46.23)	1.455 (36.96)	1.195 (30.35)	0.38 (9.65)	0.97 (24.64)	1.28 (32.51)	0.060 (1.52)
1½	2.41 (61.21)	2.045 (51.94)	1.780 (45.21)	0.50 (12.70)	1.09 (27.69)	1.41 (35.81)	0.060 (1.52)
2	3.01 (76.45)	2.520 (64.01)	2.255 (57.28)	0.50 (12.70)	1.16 (29.46)	1.54 (39.12)	0.060 (1.52)
3	4.10 (104.14)	3.680 (93.47)	3.350 (85.09)	0.75 (19.05)	1.63 (41.40)	2.00 (50.80)	0.075 (1.90)
3½	4.59 (116.59)	4.190 (106.43)	3.840 (97.54)	0.75 (19.05)	1.72 (43.69)	2.09 (53.09)	0.080 (2.03)
4	5.31 (134.87)	4.725 (120.02)	4.310 (109.47)	0.75 (19.05)	1.78 (45.21)	2.28 (57.91)	0.095 (2.41)
5	6.36 (161.54)	5.805 (147.45)	5.363 (136.22)	1.00 (25.40)	1.97 (50.04)	2.47 (62.74)	0.100 (2.54)
6	7.38 (187.45)	6.920 (175.77)	6.375 (161.92)	1.00 (25.40)	2.16 (54.86)	2.66 (67.56)	0.125 (3.18)
Tolerance	±0.020 (±0.51)	±0.020 (±0.51)	+0.010 (+0.25)	±0.02 (±0.51)	±0.02 (±0.51)	±0.02 (±0.51)	+0.020 (+0.51)