



Designation: ~~F1837M – 97 (Reapproved 2012)~~^{ε1} **F1837M – 97 (Reapproved 2018)** National Standard

Standard Specification for Heat-Shrink Cable Entry Seals (Metric)¹

This standard is issued under the fixed designation F1837M; 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.

^{ε1} NOTE—Reapproved with editorial changes in October 2012.

1. Scope

1.1 This specification covers the general requirements for heat-shrink cable entry seals. Cable entry seals are intended for making electrical cable penetrations into connection boxes, bulkheads, or other enclosures. These devices are suitable for both thin wall enclosures up to 5 mm ($\frac{3}{16}$ in.) thick and thick-wall enclosures of 5 mm to 19 mm ($\frac{3}{16}$ in. to $\frac{3}{4}$ in.) thick.

1.2 Cable entry seals shall have factory-applied adhesive that provides the seal to wire and cable jackets.

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only—mathematical conversions to inch-pound units that are provided for information only and are not considered standard.

1.4 *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 its 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

D149 Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies

D257 Test Methods for DC Resistance or Conductance of Insulating Materials

ASTM F1837M-97(2018)

<https://standards.iteh.ai/catalog/standards/astm/91dea4b5-aa48-405a-8090-753693c7b665/astm-f1837m-972018>

¹ This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.10 on Electrical.

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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.

- D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
- D570 Test Method for Water Absorption of Plastics
- D635 Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
- D747 Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D2240 Test Method for Rubber Property—Durometer Hardness
- D2671 Test Methods for Heat-Shrinkable Tubing for Electrical Use
- D2863 Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)
- D3149 Specification for Crosslinked Polyolefin Heat-Shrinkable Tubing for Electrical Insulation
- ~~D4572~~D4066 Test Method for Rubber Chemicals—Wet Sieve Analysis of Sulfur
- Classification System for Nylon Injection and Extrusion Materials (PA)
- D4732 Specification for Cool-Application Filling Compounds for Telecommunications Wire and Cable
- 2.2 ASME Standard:³
- ASME B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)
- 2.3 NEMA Standard:⁴
- NEMA 250 Enclosures for Electrical Equipment (1000 Volts Max)
- 2.4 IEC Standard:⁵
- IEC 68-2-6 Environmental Testing—Part 2: Tests—Test FC: Vibration (~~Sinusoidal~~)(Sinusoidal), Sixth Edition

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

- 3.1.1 *heat-shrink cable entry seal, n*—heat-shrinkable tube making a watertight, fume-tight seal where cable connections boxes, bulkheads, or other enclosures.
- 3.1.2 *polyolefin, n*—a polymer made by the polymerization of hydrocarbon olefins or copolymerization olefins.

4. Classification

4.1 Heat-shrink cable entry seals shall be of the following types:

- 4.1.1 *Type I*, standard cable entry seals for thin-wall enclosures shall consist of the three part assembly; a rigid plastic nut, O-ring, and heat-shrinkable molded area.
- 4.1.1.1 *Type I-1*, molded area configured with one opening for a single wire or cable entry.
- 4.1.1.2 *Type I-2*, molded area configured with two equal size openings to seal two wires or cables.
- 4.1.1.3 *Type I-3*, molded area configured with three equal size openings to seal three wires or cables.
- 4.1.1.4 *Type I-4*, molded area configured with four equal size openings to seal four wires or cables.
- 4.1.1.5 *Type I-5*, molded area configured with six equal size openings to seal six wires or cables.
- 4.1.1.6 *Type I-6*, molded area configured with eight equal size openings to seal eight wires or cables.
- 4.1.2 *Type II*, cable entry seal for threaded hole applications shall consist of a one-part assembly that combines a tapered national pipe thread (NPT) in rigid plastic with heat-shrinkable molded area.
- 4.1.2.1 *Type II-1*, molded area configured with one opening for a single wire or cable entry.
- 4.1.2.2 *Type II-2*, molded area configured with two equal size openings to seal two wires or cables.
- 4.1.2.3 *Type II-3*, molded area configured with three equal size openings to seal three wires or cables.
- 4.1.2.4 *Type II-4*, molded area configured with four equal size openings to seal four wires or cables.
- 4.1.3 *Type III*, right angle cable entry seal for thin-wall enclosure shall consist of a three part assembly; a rigid plastic nut, O-ring, and heat-shrinkable molded area.
- 4.1.4 *Type IV*, right angle cable entry seal for threaded hole application shall consist of a one-part assembly that combines a tapered national pipe thread (NPT) in rigid plastic with a heat-shrinkable molded area.

5. Ordering Information

5.1 Orders for cable entry seals under this specification shall include the following:

- 5.1.1 Part Number (see [Figs. 1-6](#)).
- 5.1.2 Quantity (per each part).

³ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, ~~Three~~Two Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁴ Available from National Electrical Manufacturers Association (NEMA), 1300 N. 17th St., Suite 1752, Rosslyn, 900, Arlington, VA 22209, <http://www.nema.org>.

⁵ Available from International Electrotechnical Commission (IEC), 3, rue de Varembe, Case Postale Varembe, 1st floor, P.O. Box 131, CH-1211, Geneva 20, Switzerland/Switzerland, <https://www.iec.ch>.

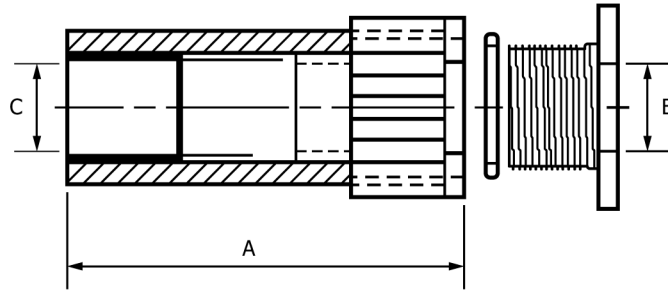


FIG. 1 Type I-Single-Legged Standard Cable Entry Seals

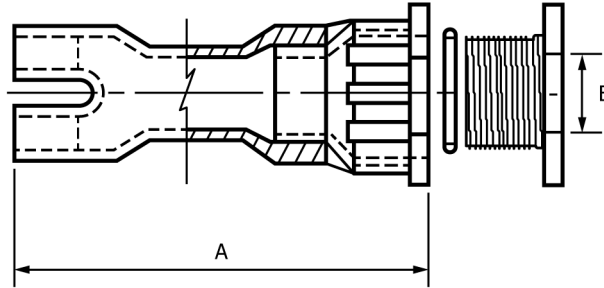


FIG. 2 Type I-Multi-Legged Standard Cable Entry Seals

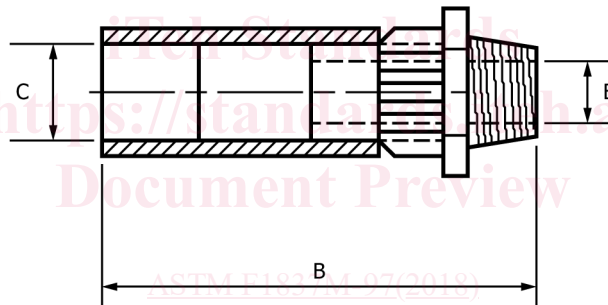


FIG. 3 Type II-Single-Legged Threaded Cable Entry Seals

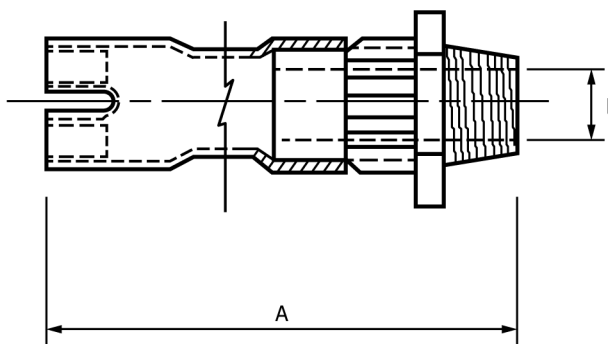


FIG. 4 Type II-Multi-Legged Threaded Cable Entry Seals

6. Materials and Manufacture

6.1 The rigid plastic parts shall be made from polyamide (nylon), or polyester material, or both. The material shall be Group 1, Class 8, Grade 1 as specified in Specification [D4066](#).

6.1.1 Threads shall be unified form UN 2A or 2B or taper pipe thread (NPT) as specified in ASME [B1.1-1](#).

6.2 The heat-shrinkable tubing shall be of a crosslinked polyolefin in accordance with Type III of Specification [D3149](#).

6.3 The adhesive shall be general purpose high-bond-strength adhesive sealant that provides stain relief and environmental sealing of heat-shrink tubing to cable jackets.

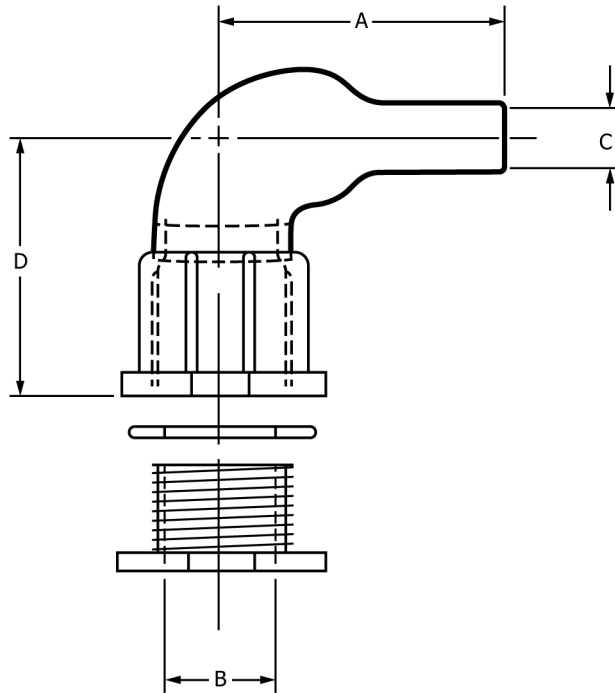


FIG. 5 Type III-Right-Angle Cable Entry Seals

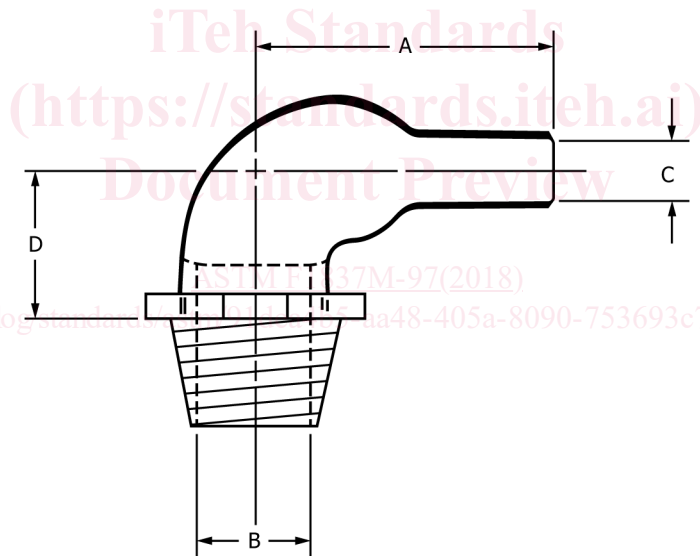


FIG. 6 Type IV-Right-Angle Cable Entry Seals

6.4 O-rings shall be made of a material conforming to Type II of Specification [D4732](#).

6.5 The polyolefin heat-shrinkable tubing shall meet requirements of Test Methods [D2671](#).

7. Other Requirements

7.1 *Dimensional Requirements*—Cable-entry seals shall conform to the dimensional requirements of [Tables 1-6](#). Type I cable-entry seals are presented in [Fig. 1](#) and [Fig. 2](#). Type II cable-entry seals are presented in [Fig. 3](#) and [Fig. 4](#). Right-angle cable-entry seals (Types III and IV) are presented in [Fig. 5](#) and [Fig. 6](#).

7.2 Performance Requirements:

7.2.1 *Vibration Resistance*—When cable-entry seals are tested as specified in [9.1](#), there shall be no evidence of cracking or loosening of parts.

7.2.2 *Ruggedness*—When cable-entry seals are subjected to a mechanical abuse test as specified in [9.2](#), there shall be no cracking, breaking, distortion, or damage to the sample.

TABLE 1 Type 1—Single Legged Standard Cable Entry Seals^A

C		B		A	
Tubing					
Expanded I.D. (min)	Recovered I.D. (max)	I.D. (min)	Overall Nominal Recovered Length	Recommended Hole Diameter	Part No. ^B
13.0 (0.50)	3.0 (0.12)	19.0 (0.75)	89.0 (3.50)	25.5 (1.00)	CES S 1-1
19.0 (0.75)	6.5 (0.25)	19.0 (0.75)	89.0 (3.50)	25.5 (1.00)	CES S 1-2
19.0 (0.75)	6.5 (0.25)	19.0 (0.75)	32.0 (1.25)	25.5 (1.00)	CES S 1-3
28.5 (1.20)	13.0 (0.50)	28.0 (1.10)	95.0 (3.75)	35.0 (1.38)	CES S 1-4
35.0 (1.38)	13.0 (0.50)	28.0 (1.10)	95.0 (3.75)	44.5 (1.75)	CES S 1-5
40.0 (1.70)	19.0 (0.75)	40.0 (1.60)	120.0 (4.75)	51.0 (2.00)	CES S 1-6
70.0 (2.75)	19.0 (0.75)	53.0 (2.10)	102.0 (4.00)	60.0 (2.36)	CES S 1-7
70.0 (2.75)	36.0 (1.43)	74.0 (2.90)	178.0 (7.00)	89.0 (3.50)	CES S 1-8

^A Dimensions shown are nominal and in ~~millimeters (in)~~ millimetres (inches).

^B Part numbers were established in the following way:

CE~~S~~—cable CE~~S~~—cable entry seal,

S or T—standard or threaded, and

1-1—number 1-1—number preceding hyphen represents number legs; number following hyphen represents size type.

TABLE 2 Type 1—Multi-Legged Standard Cable Entry Seals^A

		B		A		
		Multi-Leg Boot				
No. of Legs	Expanded I.D. Min.	Recovered I.D. Max.	I.D. (min)	Overall Nominal Recovered Length	Recommended Hole Diameter	Part No. ^B
	(Each Leg)	(Each Leg)				
2	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	89.0 (3.50)	25.5 (1.00)	CES S 2-1
2	15.0 (0.60)	4.5 (0.17)	28.0 (1.10)	95.0 (3.75)	35.0 (1.38)	CES S 2-2
2	23.0 (0.90)	7.5 (0.30)	40.0 (1.60)	120.0 (4.75)	51.0 (2.00)	CES S 2-3
3	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	89.0 (3.50)	25.5 (1.00)	CES S 3-1
3	15.0 (0.60)	4.5 (0.17)	28.0 (1.10)	95.0 (3.75)	35.01 (1.38)	CES S 3-2
3	23.0 (0.90)	7.5 (0.30)	40.0 (1.60)	120.0 (4.75)	51.0 (2.00)	CES S 3-3
3	32.0 (1.25)	13.0 (0.50)	74.0 (2.90)	178.0 (7.00)	89.0 (3.50)	CES S 3-4
4	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	89.0 (3.50)	25.5 (1.00)	CES S 4-1
4	15.0 (0.60)	4.5 (0.17)	28.0 (1.10)	95.0 (3.75)	35.0 (1.38)	CES S 4-2
4	23.0 (0.90)	7.5 (0.30)	40.0 (1.60)	120.0 (4.75)	51.0 (2.00)	CES S 4-3
4	32.0 (1.25)	13.0 (0.50)	74.0 (2.90)	178.0 (7.00)	89.0 (3.50)	CES S 4-4
6	23.0 (0.90)	7.5 (0.30)	74.0 (2.90)	178.0 (7.00)	89.0 (3.50)	CES S 6-1
8	23.0 (0.90)	7.5 (0.30)	74.0 (2.90)	178.0 (7.00)	89.0 (3.50)	CES S 8-1

^A Dimensions shown are nominal and in ~~millimeters~~ millimetres (inches).

^B Part numbers were established in the following way:

CE~~S~~—cable entry seal,

S or T—standard or threaded, and

1-1—number preceding hyphen represents number of legs; number following hyphen represents size type.

7.2.3 Effectiveness of Seal—When cable-entry seals are tested as specified in 9.3, there shall be no evidence of leakage through or around the cable entry seals.

8. Workmanship, Finish, and Appearance

8.1 Cable-entry seals shall be free from warp, cracks, chipped edges, or surfaces, blisters, uneven surfaces, scratches, dents, and flow lines. They shall be free from fins, burrs, and unsightly finish caused by chipping, filling, or grinding without subsequent buffing or polishing. All molded parts shall be cleaned thoroughly of annealing mediums.

9. Test Methods

9.1 Conformance testing of a random sample may be requested by the purchaser in order to verify that selected performance characteristics specified herein have been incorporated in the cable-entry seal design and maintained in production.

9.1.1 **Vibration**—The cable-entry seals shall be subjected to vibration testing as specified in IEC Standard 68-2-6. The following details shall apply:

9.1.1.1 The cable-entry seals shall be complete with O-rings and 1 to 2-m (3 to ~~6-ft~~ 6-ft) lengths of cable of appropriate size.

9.1.1.2 The free end of the cables shall be secured to prevent excessive cable whipping action during test.

9.1.1.3 Tests are to be carried out in three perpendicular planes.

9.1.1.4 Duration of the test for no resonance condition shall be 90 min at 30 Hz. Duration at each resonance frequency at which $Q > 2$ is recorded. It is recommended as guidance that Q does not exceed 5.

9.1.1.5 Test range shall be 2 ± 0.3 Hz to 13.2 Hz—amplitude ± 1 mm; 13.2 Hz to 100 Hz—acceleration ± 7 g.

TABLE 3 Type II—Single-Legged Threaded Cable Entry Seals^A

C		B	A		NPT Pipe Size	Part No. ^B
Tubing		I.D. (min.)	Overall Nominal Recovered Length			
Expanded I.D. (Min.)	Recovered I.D. (Max.)					
9.5 (0.37)	3.0 (0.12)	6.5 (0.25)	87.0 (3.40)	6.5 (0.25)	CST T 1-1	
14.5 (0.57)	5.0 (0.19)	14.0 (0.55)	87.0 (3.40)	13.0 (0.50)	CES T 1-2	
19.0 (0.75)	6.5 (0.25)	14.0 (0.55)	87.0 (3.40)	13.0 (0.50)	CES T 1-3	
19.0 (0.75)	6.5 (0.25)	19.0 (0.75)	87.0 (3.40)	19.0 (0.75)	CES T 1-4	
19.0 (0.75)	6.5 (0.25)	19.0 (0.75)	89.0 (3.50)	25.5 (1.00)	CES T 1-5	
32.0 (1.25)	13.0 (0.50)	25.5 (1.00)	112.0 (4.40)	25.5 (1.00)	CES T 1-6	
32.0 (1.25)	13.0 (0.50)	28.0 (1.10)	119.0 (4.70)	38.0 (1.50)	CES T 1-7	
51.0 (2.00)	19.0 (0.75)	36.0 (1.40)	127.0 (5.00)	38.0 (1.50)	CES T 1-8	
70.0 (2.75)	25.5 (1.00)	61.0 (2.40)	152.0 (6.00)	63.5 (2.50)	CES T 1-9	

^A Dimensions shown are nominal and in the millimeters/millimetres (inches).

^B Part numbers were established in the following way:

CES—cable entry seal,

S or T—standard or threaded, and

1-1—number preceding hyphen represents number of legs; number following hyphen represents size type.

TABLE 4 Type II—Multi-Legged Threaded Cable Entry Seals^A

No. of Legs	Multi-Leg Boot		B	A		NPT Pipe Size	Part No. ^B
	Expanded I.D. Min. (Each Leg)	Recovered I.D. Max. (Each Leg)	I.D. (Min.)	Overall Nominal Recovered Length			
2	10.0 (0.40)	3.0 (0.11)	14.0 (0.55)	87.0 (3.40)	13.0 (0.50)	CES T 2-1	
2	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	87.0 (3.40)	19.0 (0.75)	CES T 2-2	
2	15.0 (0.60)	4.5 (0.18)	28.0 (1.10)	112.0 (4.40)	25.5 (1.00)	CES T 2-3	
2	15.0 (0.60)	4.5 (0.18)	28.0 (1.10)	119.0 (4.70)	38.0 (1.50)	CES T 2-4	
2	23.0 (0.90)	7.5 (0.30)	37.0 (1.47)	119.0 (4.70)	38.0 (1.50)	CES T 2-5	
3	10.0 (0.40)	3.0 (0.11)	14.0 (0.55)	95.0 (3.75)	13.0 (0.50)	CES T 3-1	
3	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	94.0 (3.70)	19.0 (0.75)	CES T 3-2	
3	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	95.0 (3.75)	25.5 (1.00)	CES T 3-3	
3	15.0 (0.60)	4.5 (0.18)	28.0 (1.10)	112.0 (4.40)	25.5 (1.00)	CES T 3-4	
3	15.0 (0.60)	4.5 (0.18)	28.0 (1.10)	119.0 (4.70)	38.0 (1.50)	CES T 3-5	
3	23.0 (0.90)	7.5 (0.30)	37.0 (1.47)	127.0 (5.00)	38.0 (1.50)	CES T 3-6	
3	32.0 (1.25)	13.0 (0.50)	61.0 (2.40)	152.0 (6.00)	63.5 (2.50)	CES T 3-7	
4	10.0 (0.40)	3.0 (0.11)	14.0 (0.55)	87.0 (3.40)	13.0 (0.50)	CES T 4-1	
4	10.0 (0.40)	3.0 (0.11)	19.0 (0.75)	87.0 (3.40)	19.0 (0.75)	CES T 4-2	
4	15.0 (0.60)	4.5 (0.18)	28.0 (1.10)	112.0 (4.40)	25.5 (1.00)	CES T 4-3	
4	15.0 (0.60)	4.5 (0.18)	28.0 (1.10)	119.0 (4.70)	38.0 (1.50)	CES T 4-4	
4	23.0 (0.90)	7.5 (0.30)	37.0 (1.47)	127.0 (5.00)	38.0 (1.50)	CES T 4-5	
4	32.0 (1.25)	13.0 (0.50)	61.0 (2.40)	152.0 (6.00)	63.5 (2.50)	CES T 4-6	

^A Dimensions shown are nominal and in millimeters/millimetres (inches).

^B Part numbers were established in the following way:

CES—cable entry seal and

S or T—standard or threaded.

TABLE 5 Type III—Right Angle Cable Entry Seals^A

C		B	A		D	Recommended Hole Diameter	Part No. ^B
Tubing		I.D. (min.)	Overall Nominal Recovered Length				
Expanded I.D. (min.)	Recovered I.D. (max.)						
14.0 (0.55)	7.0 (0.28)	14.0 (0.55)	36.0 (1.40)	43.0 (1.68)	25.5 (1.00)	CES SR-1	
19.0 (0.75)	8.5 (0.33)	19.0 (0.75)	43.0 (1.70)	45.0 (1.77)	25.5 (1.00)	CES SR-2	
28.0 (1.10)	16.0 (0.62)	28.0 (1.10)	79.0 (3.10)	58.0 (2.30)	35.0 (1.37)	CES SR-3	
40.0 (1.60)	16.0 (0.62)	40.0 (1.60)	79.0 (3.10)	71.0 (2.80)	51.0 (2.00)	CES SR-4	

^A Dimensions shown are nominal and in millimeters/millimetres (inches).

^B Part numbers were established in the following way:

CES—cable entry seal,

S or T—standard or threaded, and

R-1—Right angle; number following hyphen represents size type.

9.1.1.6 Nonconformance to the requirements of 7.2.1 shall be cause for rejection.