

NEMA Standards Publication

ANSI C80.6-2018

Electrical Intermediate Metal Conduit





ANSI C80

American National Standard
Electrical Intermediate Metal Co

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Published by

National Electrical Manufacturers Association
1300 North 17th Street, Suite 900
Arlington, VA 22209

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Foreword (This Foreword is not part of American National Standard C80.6-2018)

This standard was developed by the Accredited Standards Committee on Raceways for Electrical Systems, ASC C80. The objective of the committee is to produce a comprehensive specification that would establish uniform dimensions and standard construction requirements for Electrical Steel Metal Conduit, Electrical Metallic Tubing, Electrical Intermediate Metal Conduit and Electrical Rigid Aluminum Conduit raceway products and their associated components.

The standard was originally approved in 1986 and revised in 1994 and 2005.

Suggestions for improvement of this standard will be welcomed. They should be sent to:

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This standard was processed and approved for submittal to ANSI by the Accredited Standards Committee on Raceways for Electrical Wiring Systems, C80. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the C80 Committee had the following members:

Jay Burris, Chairman
Raymond Horner, Vice-Chairman
Muhammad Ali, Secretary

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The following members of the NEMA Steel Conduit & Electrical Metallic Tubing (05RN) - Codes/Communications/ Technical Committee worked on this standard prior to its publication:

Jay Burris, Co-Chairman

CONTENTS

1 Scope

2 Normative References

3 Definitions.....

4 Units of Measurements

5 General Requirements

 5.1 Circular cross section

 5.2 Wall thickness

 5.3 Interior surface

 5.4 Welding

 5.5 Cleaning

 5.6 Protective coating for corrosion resistance

6 Detailed Requirements.....

 6.1 Exterior coating

 6.2 Interior coating

 6.3 Threading and chamfering

 6.4 Identification

 6.5 Dimensions

 6.6 Threads

 6.7 Couplings

7 Test Procedures.....

 7.1 Bending properties

ANSI C80.6-2018
Page iv

8.2 Visual inspection of conduit.....

8.3 Retests

9 Markings.....

9.1 General.....

Table 1 Dimensions of threads for intermediate metal conduit.....

Table 2 Dimensions of intermediate metal conduit

Table 3 Dimensions of straight-tapped couplings

Table 4 Minimum Dimensions of 90-degree elbows and weights of nipples per hundred

Figure 1 Test apparatus for bending conduit

Figure 2 Conduit bend

1 Scope

This standard covers the requirements for steel electrical intermediate metal conduit for use as a raceway for wires or cables of an electrical system. Finished conduit is produced in nominal 10 ft. (3.05 m) lengths, threaded on each end with one coupling attached. It is protected on the exterior surface with a minimum zinc coating or an alternate corrosion protection coating (See UL 1242 for alternate corrosion-resistance coating(s) requirements) and on the interior surface with a zinc or organic coating.

This standard also covers conduit couplings, elbows, and conduit lengths other than 10 ft. (3.05 m). Properly assembled systems of conduit, couplings, elbows, and nipples manufactured in accordance with this standard, and other identified fittings, provide for the electrical continuity required of an equipment grounding conductor.

2 Normative References

The following standards contain provisions which, through reference in this text, constitute requirements of this American National Standard. At the time of this publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below unless otherwise specified.

ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch) 2013

ASTM A 239-14, Standard Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron or Steel Articles.

ASTM B 499-09 (2014), Standard Test Method for Measurement of Coating Thicknesses by the Magnetic Method: Nonmagnetic Coatings on Magnetic Basis Metals

UL 1242-2014, Electrical Intermediate Metal Conduit—Steel

3 Definitions

3.1 alternate corrosion resistant coating (ACRC): A coating(s), other than one consisting of zinc, which, upon evaluation, has demonstrated the ability to provide the level of corrosion resistance required on the exterior of the conduit. It is not prohibited that the coatings include zinc. (See UL 1242-2014)

3.2 elbow: A manufactured curved section of IMC threaded on each end.

3.3 electrical intermediate metal conduit (IMC): A threadable steel raceway of circular cross-section designed for the physical protection and routing of conductors and cables and use as an equipment grounding conductor.

3.4 finished conduit: A straight length of IMC with one coupling attached.

ANSI C80.6-2018

Page 2

4 Units of Measurements

The values stated first in English (US Customary) Units are to be regarded as the standard. The (metric) units in parentheses are explanatory or approximate, and for safety, considerations are to be considered as information, only.

5 General Requirements

5.1 Circular Cross Section

Electrical intermediate metal conduit (IMC) shall have a circular cross-section sufficiently accurate to permit the cutting of threads in accordance with Table 1.

5.2 Wall Thickness

The wall thickness shall be uniform throughout and in accordance with Table 2:

5.3 Interior Surface

The interior surface shall be free from injurious defects.

5.4 Welding

The welding of all seams shall be continuous and done in a free of blisters like manner.

5.5 Cleaning

The conduit shall be adequately cleaned before the application of the protective coating. The cleaning process shall leave the exterior and interior surfaces of the conduit in such a condition that the protective coating shall be smooth and adhere firmly.

5.6 Protective Coating for Corrosion Resistance

5.6.1 The exterior surface shall be either thoroughly and evenly coated with metallic zinc or provided with an alternate corrosion resistant coating (ACRC). (See UL 1242 - 2014 alternate corrosion-resistant coatings requirements).

5.6.2 The interior surface shall be protected by a zinc or organic coating. The interior coating shall have a smooth continuous surface. An occasional variation due to uneven flow of coating shall be acceptable.

5.6.3 Conduit and fittings constructed of stainless steel are not required to be provided with interior exterior protective coatings.

5.7 Surface Treatment

Any surface treatment not exceeding 0.00015 in. (0.0038 mm) that is employed as a topcoat or conversion coating is not required to meet the requirements for an ACRC or organic coating.

6.1.2 Alternate corrosion resistant coatings (ACRC) (See UL 1242-2014.)

6.2 Interior Coating

6.2.1 The zinc coating shall be tested in accordance with 7.1.2.

6.2.2 The organic coating shall not soften at a temperature of 120°F (49°C) and shall be sufficiently elastic to meet the test described in 7.4.

6.3 Threading and Chamfering

Each length of conduit and elbow shall be threaded on both ends, and each end shall be chamfered or otherwise treated to remove burrs and sharp edges.

Threads shall comply with the requirements of 6.6. If threads are cut after the zinc coating has been applied, the threads shall be treated with a protective coating to prevent corrosion before installation. This treatment shall not impair electrical continuity through couplings or fittings after installation.

6.4 Identification

Each length of conduit and elbow shall be identified in accordance with 9.

6.5 Dimensions

The dimensions of IMC shall be in accordance with Table 2.

6.6 Threads

The number of threads per inch (threads per 25.4 mm), and the length of the threaded portion at each end of each length of conduit and elbow shall be as indicated in Table 1, and shall conform to American National Standard for Pipe Threads, General Purpose (Inch) ANSI/ASME B1.20.1. The perfect thread shall be tapered for its entire length, and the taper shall be $\frac{3}{4}$ in./ft. (1 in 16).

6.7 Couplings

Couplings shall comply with the following requirements:

6.7.1 The exterior surface of couplings shall be protected against corrosion in the same manner required for conduit and shall comply with the requirements of 6.1.1 and 6.1.2. The interior surface shall be treated to inhibit corrosion from taking place prior to installation. This treatment shall not impair electrical continuity between the couplings and conduit after installation.

6.7.2 Couplings shall be so made that all threads on the conduit will be covered when the coupling is made up "wrench tight" on conduit threads that met the requirements of 6.6.

6.7.3 Both ends of the coupling shall be chamfered to prevent damage to the starting thread.

6.7.4 The outside diameter, length, pitch diameter, and chamfer diameter of couplings shall be as indicated in Table 3.

ANSI C80.6-2018

Page 4

7 Test Procedures

7.1 Bending Properties

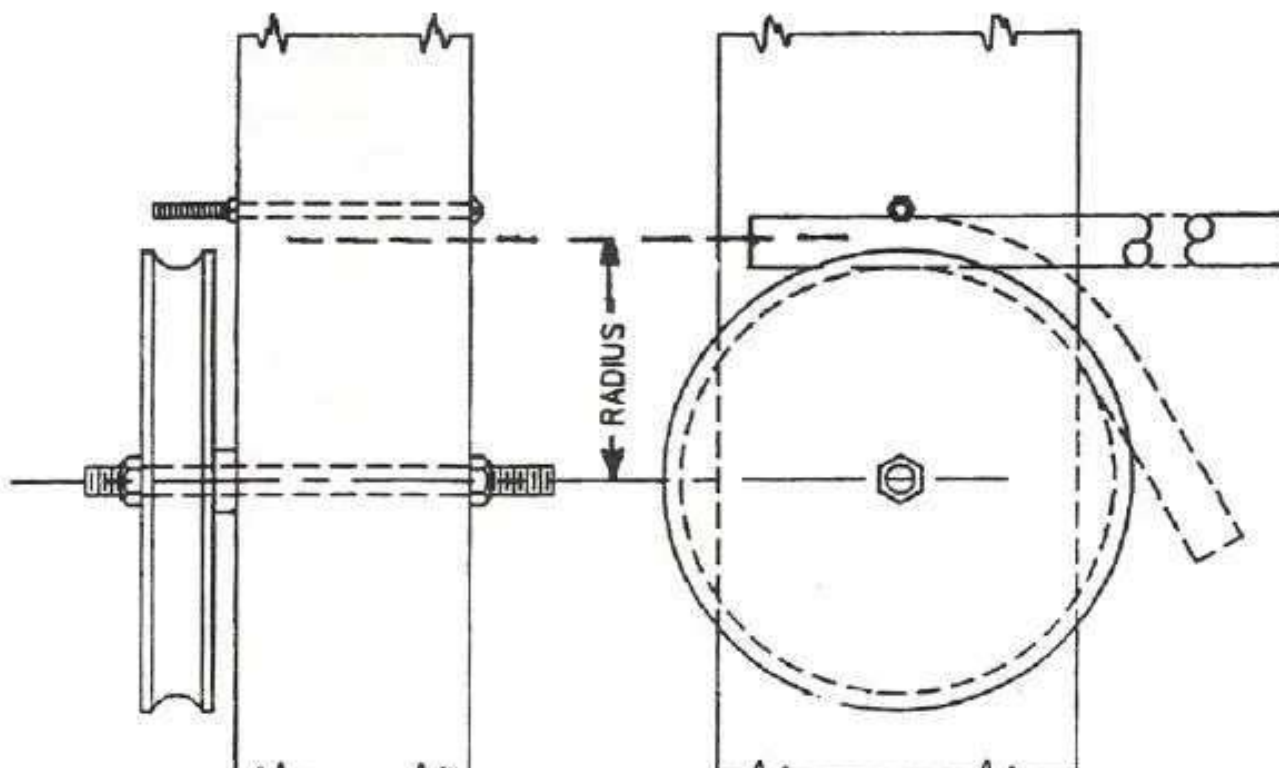
7.1.1 Ductility of Steel

Conduit shall be capable of being bent, at ambient temperature, 90 degrees around a mandrel, the radius of which is shown in Table 4, without developing cracks at any portion of the bend and without opening the weld.

7.1.2 Ductility of the Coatings at Ambient Temperature

The protective coatings used on the exterior and interior surfaces of IMC shall be sufficiently elastic to prevent their cracking or flaking off when a finished sample of trade size 1/2 (16) or the smallest trade size manufactured is tested at ambient temperature. The test shall be performed within 1 year after time of manufacture, by bending trade size 1/2 (16) 180 degrees around a mandrel, the radius of which is shown in Table 4. Samples of other trade sizes shall be bent 90 degrees around a mandrel, the radius of which is shown in Table 4.

Compliance of trade sizes 1/2 (16) and 3/4 (21) shall be determined by bending the conduit with the equipment shown in Figure 1. Compliance of trade sizes larger than 3/4 (21) shall be determined by bending the conduit with any suitable bending equipment.



7.2 Thickness of Zinc Coating

One of the following test methods shall be employed for measuring the thickness or extent of the zinc coating on conduit:

- a. Magnetic test in accordance with ASTM B 499.
- b. Copper sulfate test (Preece Test) in accordance with ASTM A 239. Material that will withstand four 1-minute immersions shall be considered as meeting the requirements of 6.1.1.
- c. Copper sulfate test method for zinc coating in accordance with UL 1242-2014.

7.3 Alternate Corrosion Resistant Coatings (ACRC) (See UL 1242-2014.)

7.4 Quality of Organic Coating for Use on Interior Surface

Two test pieces of uncoated sheet steel, 3 in. × 5 in. × 0.010 in. (76.2 mm × 127.0 mm × 0.25 mm) shall be cleaned with a suitable solvent to remove all grease and foreign material. Each piece shall be dipped into the material used for the inside coating of the conduit. The coated test pieces shall be allowed to air-dry for 30 minutes before being placed in the baking oven. Each piece shall be suspended by means of short wires in the baking oven, and the samples shall be baked for a period of 5 hours at the normal baking temperature used in production. If the normal baking temperature is less than 275°F (135°C) or if the coating is regularly air-dried, the oven temperature shall be maintained at 275°F to 302°F (135°C to 150°C).

At the end of the 5-hour period, the test samples shall be removed from the oven and allowed to cool to room temperature. Each test piece shall be gripped in a vise and then bent from the opposite side and forth five times through an angle of 180 degrees, the radius of the bend being 1/16 inch (1.58 mm). When so tested, the coating on the sample shall not crack or flake.

8 Examination of Product

8.1 Place of Inspection

All tests and inspections shall be made at the place of manufacture prior to shipment unless otherwise specified, and shall be so conducted as not to interfere with normal manufacturing processes.

8.2 Visual Inspection of Conduit

Conduit shall be examined visually, both on the exterior and interior surfaces to determine if the product is free from slivers, burrs, scale, or other similar injurious defects and if coverage of the coating is complete.

8.3 Retests

If any sample of IMC tested as prescribed in this specification fails, two additional samples shall be tested, both of which shall comply with the requirements of this specification.

9 Markings

9.1 General

9.1.1 Each length of conduit and elbow shall be marked "Intermediate Metal Conduit" or "IMC," with the manufacturer's name or trademark, the size, and the designation of the specification to which it conforms.

ANSI C80.6-2018
 Page 6

9.1.3 Each coupling shall be die-stamped "EC" (electrical coupling) in letters not less than 1/8 mm) high.

9.1.4 Conduit marking shall be at a minimum of once every 10 ft. (3.05 m) and no less than once every piece.

9.² Supplementary coating marking
 Conduit and elbows provided with a supplementary coating, or coatings, that have not been evaluated for providing corrosion resistance for the conduit shall be marked "Corrosion protection properties of [Insert type of supplementary coating applied] coating were not investigated" or equivalent wording.

Table 1
 Dimensions of Threads for Intermediate Metal Conduit

Imperial Units					SI (Metric) Units			
Trade Size	Threads Per in.	Pitch diameter at end of thread E _o , taper 3/4 in. per ft.	Length of Thread (in.)		Metric Designator	Threads Per 25.4 mm.	Pitch diameter at end of thread E _o , taper 62.5 mm. per meter	Length of Thread (m)
			Effective L ₂	Overall L ₄				Effective L ₂
1/2	14	0.758	0.53	0.78	16	14	19.3	13.5
3/4	14	0.968	0.55	0.79	21	14	24.6	14.0
1	11-1/2	1.214	0.68	0.98	27	11-1/2	30.8	17.3
1-1/4	11-1/2	1.557	0.71	1.01	35	11-1/2	39.5	18.0
1-1/2	11-1/2	1.796	0.72	1.03	41	11-1/2	45.6	18.3
2	11-1/2	2.269	0.76	1.06	53	11-1/2	57.6	19.3
2-1/2	8	2.720	1.14	1.57	63	8	69.1	28.0
3	8	3.341	1.20	1.63	78	8	84.9	30.5
3-1/2	8	3.838	1.25	1.68	91	8	97.5	31.8
4	8	4.334	1.30	1.73	103	8	110.1	33.0

Note: Applicable tolerances: Thread length (L₄): ±1 thread, recommended practice +0, -1 Pitch ±1 turn is the maximum variation permitted from the gauging face of the working thread gauges.

ANSI C8

Table 2
Dimensions of Intermediate Metal Conduit

Imperial Units						
Trade Size	Outside Diameter (in.)		Wall Thickness (in.)		Reference Nominal Inside Diameter (in.)	Weight (lb/ft)
	Maximum	Minimum	Maximum	Minimum		
1/2	0.820	0.810	0.085	0.070	0.659	
3/4	1.034	1.024	0.090	0.075	0.863	
1	1.295	1.285	0.100	0.085	1.104	
1-1/4	1.645	1.630	0.105	0.085	1.448	
1-1/2	1.890	1.875	0.110	0.090	1.683	
2	2.367	2.352	0.115	0.095	2.150	
2-1/2	2.867	2.847	0.160	0.140	2.575	
3	3.486	3.466	0.160	0.140	3.176	
3-1/2	3.981	4.961	0.160	0.140	3.671	
4	4.476	4.456	0.160	0.140	4.166	
SI (Metric) Units						
Metric Designator	Outside Diameter (mm)		Wall Thickness (mm)		Reference Nominal Inside Diameter (mm)	Weight (kg/m)
	Maximum	Minimum	Maximum	Minimum		
16	20.83	20.57	2.16	1.79	16.74	
21	26.26	26.01	2.29	1.90	21.94	
27	32.89	32.64	2.54	2.16	28.07	
35	41.78	41.40	2.67	2.16	36.75	
41	48.01	47.62	2.79	2.29	42.74	
53	60.12	59.74	2.92	2.41	54.59	
63	72.82	72.31	4.06	3.56	64.95	
78	88.54	88.04	4.06	3.56	80.67	
91	101.12	100.61	4.06	3.56	93.25	
103	113.69	113.18	4.06	3.56	105.82	

ANSI C80.6-2018
 Page 8

Table 3
 Dimensions of Straight-Tapped Couplings

Imperial Units						
Trade Size	Outside Diameter (in.) ¹	Minimum Length (in.)	Pitch Diameter (in.)		Chamfer Diameter (in.)	
			Minimum	Maximum	Minimum	Maximum
1/2	1.010	1-5/8	0.801	0.814	0.798	0.801
3/4	1.250	1-41/64	1.011	1.024	1.008	1.011
1	1.525	1-31/32	1.267	1.283	1.260	1.267
1-1/4	1.869	2-1/32	1.612	1.628	1.605	1.612
1-1/2	2.155	2-1/16	1.852	1.868	1.845	1.852
2	2.650	2-1/8	2.327	2.343	2.320	2.327
2-1/2	3.250	3-3/16	2.806	2.828	2.800	2.806
3	3.870	3-5/16	3.431	3.453	3.425	3.431
3-1/2	4.500	3-13/32	3.931	3.953	3.925	3.931
4	4.875	3-33/64	4.431	4.453	4.425	4.431
Metric Units						
Metric Designator	Outside Diameter (mm) ¹	Minimum Length (mm)	Pitch Diameter (mm)		Chamfer Diameter (mm)	
			Minimum	Maximum	Minimum	Maximum
16	25.7	41.3	20.35	20.68	20.27	20.35
21	31.8	41.7	25.68	26.01	25.60	25.68
27	38.7	50.0	32.18	32.59	32.00	32.18
35	47.5	51.6	40.94	41.35	40.77	40.94
41	54.7	52.4	47.04	47.45	46.86	47.04
53	67.3	54.0	59.11	59.51	58.93	59.11
63	82.6	81.0	71.27	71.83	71.12	71.27
78	98.3	84.1	87.15	87.71	87.00	87.15
91	114.3	86.5	99.85	100.40	99.70	99.85
103	123.8	89.3	112.60	113.10	112.40	112.60

Notes:

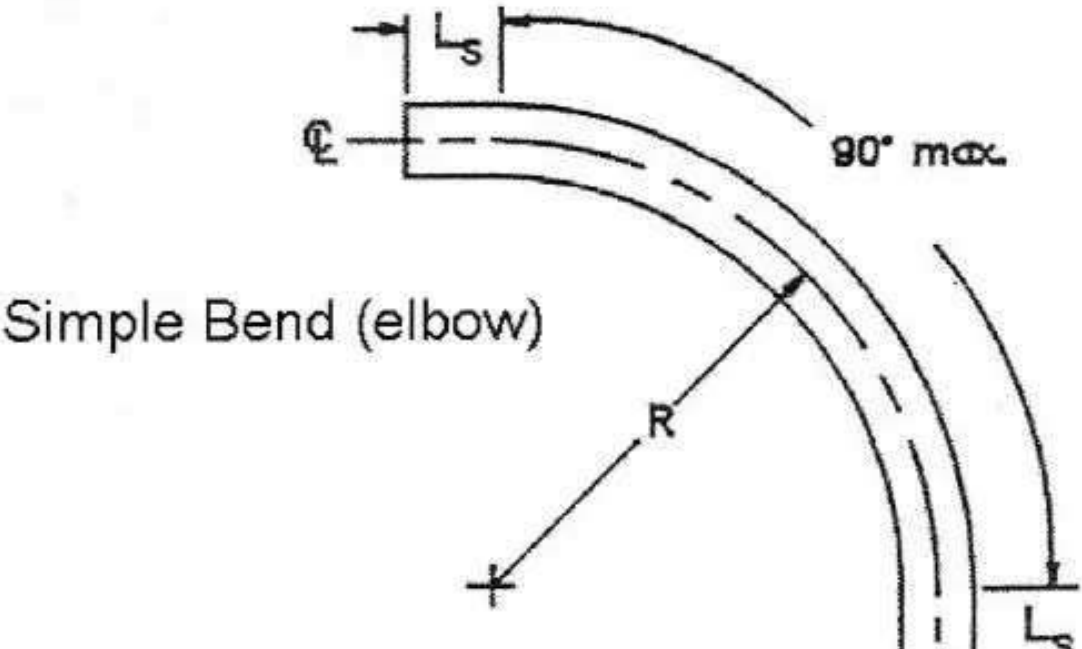
- a. Outside diameter tolerances:
 plus tolerances: no requirements
 minus tolerances:
 for trade sizes smaller than 1-1/4 (35): -1/64 in. (-0.40 mm)
 for trade sizes 1-1/4 (35) and larger: -1%
- b. Chamfer angle shall be between 11 and 15 degrees.

ANSI C8

Table 4
Minimum Dimensions of 90-degree Elbows and Weights of Nipples per Hundred

Imperial Units			Metric Units		
Trade Size	Minimum Radius R to Center of Conduit (in.)	Minimum Straight Length L _s at Each End (in.)	Metric Designator	Minimum Radius R to Center of Conduit (mm)	Min St Len at Ea (
1/2	4	1-1/2	16	102	
3/4	4-1/2	1-1/2	21	114	
1	5-3/4	1-7/8	27	146	
1-1/4	7-1/4	2	35	184	
1-1/2	8-1/4	2	41	210	
2	9-1/2	2	53	241	
2-1/2	10-1/2	3	63	267	
3	13	3-1/8	78	330	
3-1/2	15	3-1/4	91	381	
4	16	3-3/8	103	406	

Note: See Figure 5.



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