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NMX-J-536-ANCE
Third Edition



CSA Group
CSA C22.2 No. 83.1-07
Second Edition



Underwriters Laboratories Inc.
UL 797
Ninth Edition

Electrical Metallic Tubing – Steel

November 30, 2007

(Title Page Reprinted: April 28, 2023)



ANSI/UL 797-2023



Documents

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Standard for Safety for Electrical Metallic Tubing – Steel

Second Edition, Dated November 30, 2007

Summary of Topics

This revision dated April 28, 2023 includes the following changes in requirements:

- ***Introduction of a Range for the Specific Gravity; [6.2.2.1](#)***
- ***Electrical Metallic Tubing, Addition of trade sizes 5" & 6" in Steel; [5.1.2](#), [Table 5.1](#), [6.2.2.5](#), [Table 5.2](#), [B.1](#) and [Table F1](#)***
- ***Removal of "for reference only (not a requirement)" from [Table 5.2](#)***

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This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through April 28, 2023. The most recent designation of ANSI/UL 797 as an American National Standard (ANSI) occurred on April 28, 2023. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

The Department of Defense (DoD) has adopted UL 797 on January 25, 1982. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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Preface

This is the harmonized ANCE, CSA Group, and UL standard for electrical metallic tubing – steel. It is the third edition of NMX-J-536-ANCE, the second edition of CSA C22.2 No. 83.1, and the ninth edition of UL 797. This edition of CSA C22.2 No. 83.1 supersedes the previous edition published in 2004. This edition of UL 797 supersedes the previous edition published June 30, 2004. This harmonized standard has been jointly revised on April 28, 2023. For this purpose, CSA Group and UL are issuing revision pages dated April 28, 2023, and ANCE is issuing a new edition dated April 28, 2023.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL), and the conduit manufacturing industry. The efforts and support of the Technical Harmonization Subcommittee for Conduit and Tubing, of the Council of the Harmonization of Electrotechnical Standards for the Nations of the Americas (CANENA) are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

The present Mexican standard was developed by the CT 23 Electrical Accessories from the Comité de Normalización de la Asociación de Normalización y Certificación, A.C., CONANCE, with the collaboration of the Electrical Metallic tubing – steel manufacturers and users.

This standard was reviewed by the CSA Subcommittee on Metal Conduit and Tubing, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of harmonization

This standard uses an IEC format, but is not based on, nor is it to be considered equivalent to an IEC standard. This standard is published as an equivalent standard for ANCE, CSA Group, and UL. An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical deviations are allowed for codes and governmental regulations and those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental, climatic, geographical, technological or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is to be word for word except for editorial changes.

Reasons for differences from IEC

The Technical Harmonization Subcommittee identified several IEC standards that address electrical conduit and tubing included in the scope of this standard. The IEC standards for electrical conduit and tubing are recognized as being generally system-specific, containing the requirements for the relevant conduits, tubing, and associated fittings in several discrete IEC standards.

3.6 Electrical metallic tubing – steel (EMT). An unthreaded steel raceway of circular cross-section designed for the physical protection and routing of wire conductors and for use as an equipment grounding conductor when installed utilizing appropriate fittings.

3.7 Primary coating. A coating on the outside of the tubing for protection against corrosion. See Clause [5.3.1.1](#).

3.8 Supplementary coating. A coating on the outside of the tubing in addition to the primary coating, for protection against severe corrosive conditions. See Clause [5.3.5](#).

4 Units of measurement

4.1 In Canada and Mexico, the values given in SI (metric) units shall be normative. Any other values given shall be for information purposes only.

In the United States, the values stated in either SI units or inch-pound units shall be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems can result in nonconformance with the standard.

5 Construction

5.1 Tube

5.1.1 Each tube shall be of steel, shall be straight, and shall have a circular cross-section. All seams shall be thoroughly welded.

5.1.2 A welded seam shall not have metal trimmings, sharp edges, or sharp projections on the interior or exterior surfaces of the tube. A slight bead on the interior wall at the weld line shall be allowed if the bead is not sharp and if the bead does not exceed 0.38 mm (0.015 in) in height for the trade size 16 – 53 (1/2 – 2) or 0.51 mm (0.020 in) in height for the trade size 63 – 155 (2-1/2 – 6).

5.1.3 Before the protective coating is applied, the interior and exterior surfaces of each tube shall be free from scale, flash, or any other protrusion, other than as specified in Clause [5.1.2](#).

5.1.4 The end of the tubing shall be cut off squarely and shall be without any burrs and sharp edges.

5.1.5 Electrical metallic tubing shall not be threaded unless the integral fittings mentioned in Clause [5.5](#) are steel, and the thread is not of the standard pipe-thread dimensions.

5.2 Finished tubing

5.2.1 The outside diameter and the minimum weight of finished electrical metallic tubing shall be as indicated in [Table 5.1](#). The standard length of electrical metallic tubing shall be 3.05 m (10 ft) ± 6 mm ($\pm 1/4$ in). Each length of EMT shall be examined visually on both exterior and interior surfaces to determine the absence or presence of poor coatings, hard scale, burrs or fins, or other defects. See Annex [D](#).

5.2.2 Lengths, other than standard lengths, shall have a minimum acceptable weight proportional to the weights specified in [Table 5.1](#). The length tolerances in Clause [5.2.1](#) shall be applicable for non-standard lengths.

Table 5.1
Dimensions and Weights

Metric designator	Outside diameter, mm	Minimum acceptable weight, kg/m	Trade size	Outside diameter, in	Minimum acceptable weight, lbs/ft
16	17.93 ± 0.13	0.424	1/2	0.706 ± 0.005	0.285
21	23.42 ± 0.13	0.647	3/4	0.922 ± 0.005	0.435
27	29.54 ± 0.13	0.952	1	1.163 ± 0.005	0.640
35	38.35 ± 0.13	1.414	1-1/4	1.510 ± 0.005	0.950
41	44.20 ± 0.13	1.637	1-1/2	1.740 ± 0.005	1.10
53	55.80 ± 0.13	2.083	2	2.197 ± 0.005	1.40
63	73.03 ± 0.25	3.051	2-1/2	2.875 ± 0.010	2.05
78	88.90 ± 0.38	3.720	3	3.500 ± 0.015	2.50
91	101.60 ± 0.50	4.837	3-1/2	4.000 ± 0.020	3.25
103	114.30 ± 0.50	5.506	4	4.500 ± 0.020	3.70
129	141.30 ± 0.50	2.732	5	5.563 ± 0.020	7.00
155	168.28 ± 0.50	3.263	6	6.625 ± 0.020	8.37

5.2.3 Other dimensions of EMT complying with the requirements in this standard are provided in Annex [B](#) for information only.

5.3 Protective coatings

5.3.1 General

5.3.1.1 The exterior surface of EMT shall be protected against corrosion by a coating solely of zinc, as described in Clause [5.3.2](#), or an alternate corrosion-resistant coating, as described in Clause [5.3.3](#). The interior surface of the tubing shall be protected against corrosion by a coating of zinc or an organic coating, as described in Clauses [5.3.2](#) and [5.3.4](#) respectively. See Annex [C](#) for an overview.

5.3.2 Zinc coating

5.3.2.1 A protective coating of zinc shall cover completely, shall adhere firmly at all points, shall be smooth and free from blisters and other defects that can lessen the protective value of the coating, shall be in metal-to-metal contact with the steel, and shall comply with Clause [6.2.2](#).

5.3.3 Alternate corrosion-resistant coating

5.3.3.1 An alternate corrosion-resistant coating shall cover completely, shall adhere firmly at all points, and shall be smooth and free from blisters and other defects that can lessen the protective value of the coating.

5.3.3.2 An alternate corrosion-resistant coating shall comply with the requirements of Clause [6.2.4](#). The tubing or elbow shall be subjected to the assembly, bending, resistance, pull, and fault current tests in accordance with Reference Item No. 3, Annex [A](#), with both set-screw and compression type couplings, without removal of the alternate corrosion-resistant coating.

5.3.3.3 Tubing provided with a nonmetallic alternate corrosion-resistant coating that is not marked with a temperature designation, or is marked "90°C" ("200°F"), is for use in ambient temperatures that do not exceed 90°C (200°F). It is not prohibited that tubing provided with a nonmetallic alternate corrosion-resistant coating that is for use at temperatures in excess of 90°C (200°F) be marked with a rating that has been evaluated in accordance with Clause [6.2.4.4.1](#).

Table 5.2
Minimum Dimensions of Elbows

Metric Designator	Radius R to Centerline of Tubing, mm	Length L _s of Each Straight End Portion of Tubing, mm	Trade Size	Radius R to Centerline of Tubing in	Length L _s of Each Straight End Portion of Tubing, in
16	102	38	1/2	4	1-1/2
21	114	38	3/4	4-1/2	1-1/2
27	146	48	1	5-3/4	1-7/8
35	184	51	1-1/4	7-1/4	2
41	210	51	1-1/2	8-1/4	2
53	241	51	2	9-1/2	2
63	267	76	2-1/2	10-1/2	3
78	330	79	3	13	3-1/8
91	381	83	3-1/2	15	3-1/4
103	406	86	4	16	3-3/8
129	610	92	5	24	3-5/8
155	762	95	6	30	3-3/4

5.5 Expanded-end integral couplings

5.5.1 Electrical metallic tubing may be provided with an integral fitting such as an expanded end. Each such fitting shall comply with the relevant standard for fittings for conduit, tubing, and cable in Reference Item No. 6, Annex [A](#).

6 Test requirements

6.1 Tube

6.1.1 At ambient temperature, one specimen of the smallest available trade size of EMT shall be capable of being bent into a quarter of a circle, without the formation of any cracks in the metal, the opening of seam or weld, or the appreciable distortion of the circular cross-section of the tube. Compliance of tubing with this requirement regarding cracks and openings shall be determined, after bending, by subjecting the tubing to a visual examination.

6.1.2 After being conditioned at a temperature of 0°C (32°F) for 60 min, one specimen of the smallest available trade size of finished tube shall be capable of being bent into a quarter of a circle using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#). The same specimen may also be used to determine compliance with the coating test in Clause [6.2.1.3](#). Compliance shall be determined by bending the tube using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#). The tube shall not develop a crack and the weld shall not open. The test shall be conducted inside the cold chamber or shall begin within 15 s of removal from the cold chamber. Tubing that is provided with a nonmetallic alternate corrosion-resistant coating and that is marked with a temperature rating below "0°C" ("32°F") shall be conditioned at the rated temperature. The rated temperature shall be any temperature below 0°C (32°F) in 5°C (9°F) increments.

6.1.3 *Deleted*

6.2 Protective coatings

6.2.1 General

6.2.1.1 The protective coating used on the interior or exterior of the tubing shall not crack or flake, as visible using normal or corrected to normal vision, when a finished specimen of the smallest available trade size produced by the manufacturer is tested at ambient temperature. Testing shall be performed by bending the tubing into a semi-circle, using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#).

6.2.1.2 Deleted

6.2.1.3 One specimen of the smallest available trade size of finished tube shall be capable of being bent into a quarter of a circle using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#) being conditioned at a temperature of 0°C (32°F) for 60 min. The tube shall not develop a crack and a weld shall not open. The coatings shall not be damaged to the extent that bare metal is exposed or that the coating separates from the metal. The test shall be conducted inside the cold chamber or begun within 15 s of removal from the cold chamber. Tubing that is provided with a nonmetallic alternate corrosion-resistant coating and that is marked with a temperature rating below "0°C" ("32°F") shall be conditioned at the rated temperature. The rated temperature shall be any temperature below 0°C (32°F) in 5°C (9°F) increments.

6.2.1.4 For identification of compounds, a nonmetallic material used as an alternate corrosion-resistant or organic coating shall be subjected to the infrared spectroscopy (IR), thermogravimetric analysis (TGA), and differential scanning calorimetry (DSC) tests specified in the applicable standard for polymeric materials. See Reference Item No. 7, Annex [A](#).

6.2.1.5 The supplementary coating described in Clause [5.3.5](#) need not comply with [6.2.1.1](#).

6.2.2 Zinc coating

6.2.2.1 A solution of copper sulfate for this test shall be made from distilled water and a reagent grade of cupric sulfate (CuSO_4). In a copper container or in a glass, polyethylene, or other chemically nonreactive container in which a bright piece of copper is present, a quantity of the cupric sulfate shall be dissolved in hot distilled water. The purpose is to obtain a solution that has a specific gravity within the range of 1.183 to 1.189 after the solution is cooled to a temperature of 18.3°C (65.0°F). As necessary, any free acid that might be present shall be neutralized by the addition of approximately 1 gram of cupric oxide (CuO) or 1 gram of cupric hydroxide ($\text{Cu}(\text{OH})_2$) per liter of solution. The solution shall then be diluted with distilled water to obtain a specific gravity within a range of 1.183 to 1.189 at a temperature of 18.3°C (65.0°F). The solution shall then be filtered.

6.2.2.2 Several 150-mm (6-in) specimens shall be cut from a sample length of the finished zinc-coated tubing. With prudent attention to the risks to health and to the risk of fire, the specimens shall be cleaned with a suitable organic solvent. Each specimen shall be examined for evidence of damage to the zinc coating, and only specimens that are not damaged shall be selected for use in the test. When a zinc coating is used on the inside and outside of the tubing, half of the specimens shall be longitudinally cut in half to expose the inside surface. If a zinc coating is used only on the outside of the tubing, none of the specimens shall be cut longitudinally.

6.2.2.3 The selected specimens shall be rinsed in water, and all surfaces shall be dried with clean cheesecloth. As much of the water as possible shall be removed in the drying operation because water slows the reaction between the zinc and the solution, thereby adversely affecting the test results. The surface of the zinc shall be dry and clean before a specimen is immersed in the solution of copper sulfate.

The specimens shall not be touched by the hands or anything else that can contaminate or damage the surfaces.

6.2.2.4 A glass, polyethylene, or other chemically nonreactive beaker having a diameter equal to approximately twice the diameter measured over the specimen shall be filled with the solution of copper sulfate to a depth of not less than 76 mm (3 in). The temperature of the solution shall be maintained at $18.3 \pm 1.1^{\circ}\text{C}$ ($65.0 \pm 2.0^{\circ}\text{F}$). The specimen shall be immersed in the solution and supported on end in the center of the beaker so that not less than 64 mm (2-1/2 in) of its length is immersed. The specimen shall remain in the solution for 60 s, during which time it shall not be moved, nor shall the solution be stirred.

6.2.2.5 At the end of the 60 s period, the specimen shall be removed from the beaker, rinsed immediately in running tap water, rubbed with clean cheesecloth until any loosely adhering deposits of copper are removed, and then dried with clean cheesecloth. Again, hands and other damaging and contaminating objects and substances shall not touch the surfaces that were immersed. The part of the specimen that was immersed shall be examined, considering each broad surface separately and disregarding the portions of the specimen within 13 mm (1/2 in) of the cut ends on sizes 12 – 53 (3/8 – 2) and 25 mm (1 in) for sizes 63 – 155 (2-1/2 – 6) and within 3 mm (1/8 in) of any longitudinal edges cut in the process of preparing the specimen.

6.2.2.6 A record shall be made when the immersed part of the specimen has any deposit of bright, firmly-adhering copper exclusive of the 13 mm (1/2 in) cut-end portions and any 3 mm (1/8 in) longitudinal cut-edge portions.

6.2.2.7 When bright adhering copper is not found, the process of immersing, washing, rubbing, drying, examining, and recording shall be repeated up to the required number of immersions, or until the presence of copper is noted, whichever comes first, using the same specimen and beaker of solution. After the dips are completed on any one specimen, the portion of the solution of copper sulfate used shall be discarded. A fresh portion of the solution shall be employed for each of any succeeding specimens.

6.2.2.8 A protective zinc coating that provides the sole means of primary corrosion resistance on the exterior of the tubing shall be such that a specimen of the finished tubing does not show a bright, adherent deposit of copper after four 60-s immersions in a copper sulfate solution.

6.2.2.9 A protective zinc coating that provides the sole means of primary corrosion resistance on the interior of the tubing shall be such that a specimen of the finished tubing does not show a bright, adherent deposit of copper after one 60-s immersion in a copper sulfate solution.

6.2.2.10 When it is desired to show the character of the bright metallic copper deposit on an exposed steel surface, prepare a reference standard for comparison as follows. Partially submerge a zinc-coated specimen in strong hydrochloric acid until a violent action ceases. Immediately remove the specimen, wash, and wipe it dry. Then dip the specimen, with an area of bare surface thus exposed, including a portion with zinc coating intact, for a few seconds in the copper sulfate solution at a temperature of $16 - 20^{\circ}\text{C}$ ($61 - 66^{\circ}\text{F}$), remove it, wash it, and wipe it dry. Prepare this copper-coated reference standard at the time of testing.

6.2.2.11 For an alternate test method to the one described in Clauses [6.2.2.1](#) – [6.2.2.10](#), see Reference Item No. 8, Annex [A](#).

Annex B (informative)

B.1 Dimensions of EMT – Steel

(See Clause [5.2.3](#))

(For information only)

Metric designators	Internal diameter, mm	Wall thickness, US and Canada, mm	Wall thickness, Mexico, mm	Trade size	Internal diameter, in	Wall thickness, US and Canada, in	Wall thickness, Mexico, in
16	15.80	1.07	1.1	1/2	0.622	0.042	0.042
21	20.93	1.24	1.2	3/4	0.824	0.049	0.049
27	26.64	1.45	1.5	1	1.049	0.057	0.060
35	35.05	1.65	1.5	1-1/4	1.380	0.065	0.060
41	40.89	1.65	1.5	1-1/2	1.610	0.065	0.060
53	52.50	1.65	1.5	2	2.067	0.065	0.060
63	69.37	1.83	1.8	2-1/2	2.731	0.072	0.072
78	85.24	1.83	1.8	3	3.356	0.072	0.072
91	97.38	2.11	2.1	3-1/2	3.834	0.083	0.083
103	110.08	2.11	2.1	4	4.334	0.083	0.083
129	136.46	2.41	2.4	5	5.373	0.095	0.095
155	163.45	2.41	2.4	6	6.435	0.095	0.095

Annex F (informative)

F.1 Master Bundle Quantity

(See Clauses [7.8](#) and [7.9](#))

Table F1
Master bundle quantity – 3.05-m (10-foot) lengths

Trade size	(Metric designator)	Pieces	Feet	(Meters)	Nominal Wt/Lbs	(Wt/kg)
1/2	16	700	7000	2133.6	2100	948.0
3/4	21	500	5000	1524	2300	1037.8
1	27	300	3000	914.4	2010	916.3
1-1/4	35	200	2000	609.6	2020	911.7
1-1/2	41	150	1500	457.2	1740	789.2
2	53	120	1200	365.8	1776	807.4
2-1/2	63	61	610	185.9	1318	598.7
3	78	51	510	155.4	1341	607.8
3-1/2	91	37	370	112.8	1291	585.1
4	103	30	300	91.4	1179	535.2
5	129	25	250	76.2	1390	629.7
6	155	20	200	61.0	1328	601.7

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Summary of Topics

This revision dated March 30, 2021 includes the following changes in requirements:

- Annex [A](#) Normative References Update;
- Interpretation of Flammability Test Result for a Thin Nonmetallic Topcoat (Outermost Layer) of an Alternate Corrosion Protection System; [6.2.4.11.1](#)
- Clarification of Elbow and Bend Radius Requirements, Removal of the Term Mandrel, Addition of Exemption for Supplementary Coatings from Bend Test to Better Align with RMC Standard and Editorial Changes; [5.4.3](#), [Table 5.2](#), [6.1.2](#), [6.1.3](#), [6.2.1.1](#) – [6.2.1.3](#), [6.2.1.5](#) and [Figure 2](#)

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This ANSI/UL Standard for Safety consists of the Ninth Edition including revisions through March 30, 2021. The most recent designation of ANSI/UL 797 as an American National Standard (ANSI) occurred on March 30, 2021. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page (front and back), or the Preface.

The Department of Defense (DoD) has adopted UL 797 on January 25, 1982. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

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Preface

This is the harmonized ANCE, CSA Group, and UL standard for electrical metallic tubing – steel. It is the third edition of NMX-J-536-ANCE, the second edition of CSA C22.2 No. 83.1, and the ninth edition of UL 797. This edition of CSA C22.2 No. 83.1 supersedes the previous edition published in 2004. This edition of UL 797 supersedes the previous edition published June 30, 2004. This harmonized standard has been jointly revised on March 30, 2021. For this purpose, CSA Group and UL are issuing revision pages dated March 30, 2021, and ANCE is issuing a new edition dated March 30, 2021.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL), and the conduit manufacturing industry. The efforts and support of the Technical Harmonization Subcommittee for Conduit and Tubing, of the Council of the Harmonization of Electrotechnical Standards for the Nations of the Americas (CANENA) are gratefully acknowledged.

This standard is considered suitable for use for conformity assessment within the stated scope of the standard.

The present Mexican standard was developed by the CT 23 Electrical Accesories from the Comité de Normalización de la Asociación de Normalización y Certificación, A.C., CONANCE, with the collaboration of the Electrical Metallic tubing – steel manufacturers and users.

This standard was reviewed by the CSA Subcommittee on Metal Conduit and Tubing, under the jurisdiction of the CSA Technical Committee on Wiring Products and the CSA Strategic Steering Committee on Requirements for Electrical Safety, and has been formally approved by the Technical Committee. This standard has been developed in compliance with Standards Council of Canada requirements for National Standards of Canada. It has been published as a National Standard of Canada by CSA Group.

Application of Standard

Where reference is made to a specific number of samples to be tested, the specified number is to be considered a minimum quantity.

Note: Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

Level of harmonization

This standard uses an IEC format, but is not based on, nor is it to be considered equivalent to an IEC standard. This standard is published as an equivalent standard for ANCE, CSA Group, and UL. An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical deviations are allowed for codes and governmental regulations and those recognized as being in accordance with NAFTA Article 905, for example, because of fundamental, climatic, geographical, technological or infrastructural factors, scientific justification, or the level of protection that the country considers appropriate. Presentation is to be word for word except for editorial changes.

Reasons for differences from IEC

The Technical Harmonization Subcommittee identified several IEC standards that address electrical conduit and tubing included in the scope of this standard. The IEC standards for electrical conduit and tubing are recognized as being generally system-specific, containing the requirements for the relevant conduits, tubing, and associated fittings in several discrete IEC standards.

The THSC determined the safe use of electrical conduit and tubing is dependent on the design and performance of the conduit and tubing systems with which they are intended to be installed. Significant investigation is required to assess safety and system compatibility issues that may lead to harmonization of traditional North American electrical conduit and tubing and associated fittings with those presently addressed in the known IEC standards. The THSC agreed such future investigation might be facilitated by completion of harmonization of the North American standards for electrical conduit and tubing and their fittings.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is to be based on the literal text to determine compliance with the standard in accordance with the procedural rules of the standards development organization. If more than one interpretation of the literal text has been identified, a revision is to be proposed as soon as possible to each of the standards development organizations to more accurately reflect the intent.

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5.3.3.4 Tubing provided with a nonmetallic alternate corrosion-resistant coating that is not marked with a temperature designation, or is marked "0°C" ("32°F"), is for use in ambient temperatures not below 0°C (32°F). It is not prohibited that tubing provided with a nonmetallic alternate corrosion-resistant coating that is for use at temperatures below 0°C (32°F) be marked with a rating that has been evaluated in accordance with Clauses [6.2.1.3](#) and [6.2.4.10](#).

5.3.4 Organic coating

5.3.4.1 An organic coating shall cover evenly the surface to which it is applied, shall be of uniform quality throughout, shall have a smooth and even appearance, and shall comply with Clause [6.2.3](#) and the bending requirements of Clause [6.2.1.1](#).

5.3.5 Supplementary coating

5.3.5.1 The use of one or more supplementary coatings is not prohibited. The supplementary coating or coatings are not required to meet the requirements for primary corrosion-resistant coatings. Tubing or elbows that are provided with supplementary coatings that have not been evaluated for their corrosion resistance characteristics shall be marked in accordance with Clause [7.7](#).

5.3.5.2 Supplementary nonmetallic coatings shall be evaluated with respect to:

- a) flame propagation,
- b) detrimental effects on the corrosion resistance provided by the primary protective coatings,
- c) the fit of the couplings, and
- d) electrical continuity with couplings.

See Reference Item No. 4, Annex [A](#). The supplementary coating shall be provided in addition to the full primary corrosion-resistant coating.

5.3.6 Surface treatment

5.3.6.1 When one or more surface treatments not exceeding 0.0038 mm (0.00015 in) are employed as a top coat or conversion coating, the coatings shall not be required to meet the requirements for an alternate corrosion-resistant coating or organic coating.

5.4 Elbows

5.4.1 Elbows shall be made from the same grade of tubing as that used for straight lengths of EMT and shall be treated, coated, and otherwise produced according to the requirements for EMT. See Annex [D](#).

5.4.2 An elbow may be provided with an integral coupling or other integral fitting on one or both ends. Each fitting shall comply with Reference Item No. 5, Annex [A](#).

5.4.3 The curve of an elbow shall be formed using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#). The curved portion of an elbow shall be smooth and continuous throughout the bend without creases when examined visually under an artificial light source using normal or corrected-to-normal vision. Elbows sharper than 90 degrees are not included in this standard. For each size of tubing, the length L_s of the straight portions at the ends of an elbow shall not be smaller than indicated in [Table 5.2](#). See [Figure 1](#) for illustration.

Table 5.2
Minimum Dimensions of Elbows

Metric Designator	Radius R to Centerline of Tubing, mm	Length L _s of Each Straight End Portion of Tubing, mm	Trade Size	Radius R to Centerline of Tubing, for reference only (not a requirement) in	Length L _s of Each Straight End Portion of Tubing, in
16	102	38	1/2	4	1-1/2
21	114	38	3/4	4-1/2	1-1/2
27	146	48	1	5-3/4	1-7/8
35	184	51	1-1/4	7-1/4	2
41	210	51	1-1/2	8-1/4	2
53	241	51	2	9-1/2	2
63	267	76	2-1/2	10-1/2	3
78	330	79	3	13	3-1/8
91	381	83	3-1/2	15	3-1/4
103	406	86	4	16	3-3/8

5.5 Expanded-end integral couplings

5.5.1 Electrical metallic tubing may be provided with an integral fitting such as an expanded end. Each such fitting shall comply with the relevant standard for fittings for conduit, tubing, and cable in Reference Item No. 6, Annex [A](#).

6 Test requirements

6.1 Tube

6.1.1 At ambient temperature, one specimen of the smallest available trade size of EMT shall be capable of being bent into a quarter of a circle, without the formation of any cracks in the metal, the opening of seam or weld, or the appreciable distortion of the circular cross-section of the tube. Compliance of tubing with this requirement regarding cracks and openings shall be determined, after bending, by subjecting the tubing to a visual examination.

6.1.2 After being conditioned at a temperature of 0°C (32°F) for 60 min, one specimen of the smallest available trade size of finished tube shall be capable of being bent into a quarter of a circle using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#). The same specimen may also be used to determine compliance with the coating test in Clause [6.2.1.3](#). Compliance shall be determined by bending the tube using any suitable bending equipment capable of producing elbows with a radius of the curve to the centerline not less than that referenced in [Table 5.2](#). The tube shall not develop a crack and the weld shall not open. The test shall be conducted inside the cold chamber or shall begin within 15 s of removal from the cold chamber. Tubing that is provided with a nonmetallic alternate corrosion-resistant coating and that is marked with a temperature rating below "0°C" ("32°F") shall be conditioned at the rated temperature. The rated temperature shall be any temperature below 0°C (32°F) in 5°C (9°F) increments.

6.1.3 *Deleted*