

Subject 1653

May 11, 2018

SUMMARY OF TOPICS

The following changes in requirements to the Standard for Electrical Nonmetallic Tubing, UL 1653, are being proposed:

Publish an Updated New Edition which Includes References to the Mexican Electrical Installation Code, Reference Publications and ANCE References

STP BALLOTS AND ALL COMMENTS DUE: June 25, 2018

UL's goal is to have no interest category comprise more than one-third of the STP membership balance. To improve the current balance for STP 1660, UL is looking for participants in the Supply Chain, Commercial/Industrial User, General Interest, AHJ, Government, Testing and Standards, Consumer or International interest categories. Definitions for these interest categories are available on the Standards STP Internet site:

<http://ulstandards.ul.com/develop-standards/participation/interest-categories/>

If you are interested in applying for STP 1660 membership or are aware of potential candidates for this STP, please contact the STP Project Manager, Joshua.Johnson@ul.com.

For your convenience in review, proposed additions to existing requirements are shown underlined and proposed deletions are shown ~~lined-out~~.

Publish an Updated New Edition which Includes References to the Mexican Electrical Installation Code, Reference Publications and ANCE References

RATIONALE

(Include References to the Mexican Electrical Installation Code, Reference Publications and ANCE References) Proposal submitted by: CANENA THC 23A MT8

(See 1.1, 3.1.1, 3.2, 4.1.1, 4.1.3, 4.1.4, 4.3.1, 5.10.1, 6.2.1, 9.3) In the current round of proposals to amend this standard, it is transitioning from binational to trinational status. To accommodate the adoption of this standard in all of North America, the addition of normative references to the appropriate Mexican standard is necessary.

(Specify the Impact Height) Proposal submitted by: Evangeline Cometa, CSA Group

(See 7.6.3.1) The Cold Impact test specifies an impact of 2.7 J (2.0 ft-lb) and a tup as shown in figure 2, having a mass of 1.36 kg. Since we have identified the exact energy and weight of the impact mass, we might as well specify the exact height from which to release the weight so as to product 2.7 J, instead of making the user calculate it which could lead to confusion. The impact height needs to be measured from the top of the specimen. Additionally, the procedure could be written more clearly.

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The test should also specify an impact height. Additionally, the procedure could be written more clearly.

(Removal of the Pull through Metal Wall Studs Section) Proposal submitted by: CANENA THC 23A MT8

(Delete 5.7, 7.9) A previous UL Fact-Finding Report substantiating the use of ENT when first introduced and added to the National Electrical Code indicated that ENT can be fished through metal studs without damage. This test does not offer value and there have been no known related field failures of Listed ENT.

(Consider Amendments to Address Assembly of the Terminal Adapter) Proposal submitted by: Evangeline Cometa, CSA Group

(See 8.1.1.1, 8.1.1.2, Figure 3, Figure 4,) The requirement given in 6.1 is that the assembly of the ENT and fitting shall remain secure when tested in accordance with 8.1. A fitting is either a coupling or a terminal adapter, defined under the Definition section as a “fitting used to terminate the ENT at an electrical enclosure”. Clause 8.1.1.1 indicates that both ends of couplings shall be assembled to ENT sections, but does not indicate how to assemble/test a terminal adapter.

The first question is regarding the Pull Test portion conducted on a terminal adapter in accordance with clause 8.1.3.1.

When subjected to the Pull test, is clause 6.1 intended to evaluate the connection between the ENT side of the adapter only or are we also considering the connection between the adapter and the electrical box (i.e. the threaded end of the terminal adapter)? Is the “assembly” considered to be the ENT and fitting only or would the assembly take into consideration that the other end of the Terminal Adapter will be connected to an electrical box. If it is the latter, then we should add some language to the effect that the Adapter shall be assembled and tested in a manner in which it is intended to be installed.

Each fitting test sample shall be assembled to a 385 mm (15 in) long section of the corresponding trade size ENT, however for large size samples, 15 in length is not enough to perform the bending test.

There has been confusion in the interpretation of the test specimen for the Bend and Pull test in clause 8.1.1.1. It is unclear whether the test is applicable to couplings only or including terminal adapters. Since fittings can be either couplings or an adapter used to terminate the ENT to an electrical enclosure, the clause needs editorial clarification.

(Define Room Temperature where specified) Proposal submitted by: CANENA THC 23A MT8

(See 7.1.1) There are several instances in the standard where room temperature is specified however this is not defined.

(Interpreting the Flame Test Requirements) Proposal submitted by: Evangeline Cometa, CSA Group

(See 6.2.1, 6.2.2, 8.2.1) There is confusion when interpreting the flame test requirements because clauses 6.2.1 and 8.2.1 are for plaque specimens whereas 7.2 is for the ENT specimen. The test protocol is not clear.

6.2.1 Flame states that “When subjected to the test in 8.2, specimen plaque of the fitting material shall not burn more than 10 s.” When you go to 8.2.1, it states that “Specimen plaques of the fitting material, 100 mm X 100 mm (4 in x 4 in) with a thickness equal to the min. wall thickness of the fitting material,

shall be tested in accordance with 7.2.” But when you go to 7.2.1 (Vertical flame (500W burner), the referenced test method there is the test for a wire sample. It also states that the flame shall be applied five times to three samples of each trade size, each approx. 450 mm (18 in) in length, for 15 s.

The conditioning temperature for bend and pull is 7 h at 90 ±1°C. Since these products are intended for use at maximum continuous operating temperature of 75°C, what is the intent of the 90°C conditioning temperature? Is it for accelerating aging or to simulate an emergency overload test?

(Update ENT's Maximum Size) Proposal submitted by: David Gerstetter, Underwriters Laboratory, LLC

(See 7.5.1.1, 7.5.1.2, 9.1, 9.2, 9.3, 9.4, Table 1, Table 2, Table 3) The 2017 NEC permits ENT's maximum size to be 2 ½ (63). Since UL 1653/ CSA C22.2 No. 227.1-06 already includes Certification requirements for trade size 2½ (63) and based on the typical design of ENT, those requirements may also be applied to US Certified ENT of that trade size and the US deviation can simply be removed.

Installation instructions are often revised and updated due to product part additions such as fittings, etc. Other UL standards, such as UL 5A, have been revised so that the requirement for installation instructions includes language stating “or a statement indicating where to find instructions on the manufacturer's website so that proper installation can be accomplished”. This proposal adds a similar statement to UL 1653 for consistency with other UL standards. This would then allow an installer to access the most current product installation instructions.

(Clarification of the Length of the Sample) Proposal submitted by: CANENA THC 23A MT8

(See 7.7.1) The length of the sample should be sufficient for conducting the test, i.e. wrapping the sample around the mandrel. Additionally, if it is not practical to conduct the bend inside the chamber, testing outside the chamber within 15 s should be permitted.

(Adding Tolerances to Table 3) Proposal submitted by: CANENA THC 23A MT8

(See Table 3) Tolerances are necessary for sphere dimensions since there are no nominal dimensions

PROPOSAL

1 Scope

1.1 This Standard applies to corrugated electrical nonmetallic tubing (ENT) and mechanically-attached fittings, for use in accordance with C22.1, Canadian Electrical Code, Part I (CEC) and, NFPA 70, National Electrical Code (NEC) and NOM-001-SEDE Standard for Electrical Installations (Mexico). These requirements also apply to mechanically-attached fittings integral with an outlet box.

1.2 Products covered by this Standard are intended for use:

- a) at a maximum continuous operating temperature of 75°C (167°F);
- b) at a maximum ambient temperature of 50°C (122°F);
- c) in attics provided that the ENT is installed no higher than 900 mm (3 ft) above the bottom of the ceiling joist, and the ENT material is rated minimum 60°C (140°F); and
- d) underground (direct burial), in Canada only.

1.3 This Standard does not apply to fittings that are intended to be joined by solvent cement. Solvent-attached fittings are covered by UL 651 or CSA C22.2 No. 211.2. Solvent-attached fittings integral with an outlet or flush device box are covered by UL 514C or CAN/CSA-C22.2 No. 85.

1.4 For products intended for use in Canada, general requirements are given in CSA-C22.2 No. 0.

2 Definitions

2.1 The following definitions apply to this Standard:

Adapter – a fitting used to terminate the ENT at an electrical enclosure.

Coupling – a fitting intended to connect two lengths of ENT.

Coupling, Split-Type – a two-piece coupling normally used to connect two lengths of ENT after conductors have been pulled.

Electrical Nonmetallic Tubing (ENT) – a pliable corrugated raceway of circular cross-section, capable of being bent by hand with a reasonable force, but without other assistance.

Fitting, Mechanically Attached – a component in the ENT system used to terminate a length of ENT and secured to the ENT by means other than solvent cement.

Fitting, Solvent-Attached – a component in the ENT system used to terminate a length of ENT and secured to the ENT by solvent cement.

3 General

3.1 Components

3.1.1 Except as indicated in Clause 3.1.2, a component of a product covered by this Standard shall comply with all the requirements for that component. A component shall comply with ~~both the Canadian Standards Association and Underwriters Laboratories Inc. Standards~~ the applicable Canadian, Mexican and US standards for the component.

3.1.2 A component is not required to comply with a specific requirement that:

- a) Involves a feature or characteristic not required in the application of the component in the product covered by this standard, or
- b) Is superseded by a requirement in this standard.

3.1.3 A component shall be used in accordance with its rating established for the intended conditions of use.

3.1.4 Specific components are incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specified limits, and shall be used only under those specific conditions.

3.2 Reference publications

3.2.1 For undated references to Standards, such reference shall be considered to refer to the latest edition and all revisions to that edition up to the time when this Standard was approved. For dated references to Standards, such reference shall be considered to refer to the dated edition and all revisions published to that edition up to the time the Standard was approved.

Product Standardization and Certification Center (CNCP)

NMX-E-021-CNCP

Plastic industry - Dimensions of tubes and fittings - Test method

NMX-E-208-CNCP

Plastics industry – Determination of characteristics of plastic conduit under external loads using parallel plates - Test method

Secretary of Energy (Mexico)

NOM-001-SEDE

Standard for Electrical Installations

ANCE Standards

NMX-J-565-3-ANCE

Safety requirements – Flammability of plastic materials for parts in devices and appliances – Test methods

NMX-J-192-ANCE-2009

Conductors - Resistance to flame propagation in electrical conductors – Test method

NMX-J-565/11-10-ANCE

Fire Hazard Testing – Part 11-10: Test Flames – 50 W Horizontal and Vertical Flame Test Methods

CSA Group Standards

Note: For products intended for use in Canada, general requirements are given in CSA-C22.2 No. 0

C22.1- 18 02

Canadian Electrical Code, Part I

C22.2- No. 0-10

General requirements - Canadian Electrical Code, Part I

C22.2 No. 0.3-09 (R2014)†

Test Methods for Electrical Wires and Cables

CAN/CSA-C22.2 No. 0.17-00 (R2013)(R2004)

Evaluation of Properties of Polymeric Materials

CAN/CSA-C22.2 No. 85-14 M89 (R2001)

Rigid PVC Boxes and Fittings

C22.2 No. 211.0-03 (R2013)

General Requirements and Methods of Testing for Nonmetallic Conduit

C22.2 No. 211.2-06 (R2016) M1984 (R2003)
Rigid PVC (Unplasticized) Conduit

C22.2 No. 2556-15
Wire and Cable Test Methods

UL Standards

UL 94
Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 514C
Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers

UL 651
Schedule 40 and 80 Rigid PVC Conduit and Fittings

UL 746B
Polymeric Materials – Long Term Property Evaluations

UL 746D
Polymeric Materials – Fabricated Parts

UL 1581 2556
Electrical Wires, Cables, and Flexible Cords Wire and Cable Test Methods

ANSI/NFPA (American National Standards Institute/ National Fire Protection Association Standard¹ Standard

ANSI/NFPA² 70-2017 2005
National Electrical Code

ASTM (American Society for Testing and Materials)³ Standards

D 2122-16 98 (2004)
Determining Dimensions of Thermoplastic Pipe and Fittings

D 2412-11 02
Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel Plate Loading

D 5033-00
Standard Guide for Development of ASTM Standards Relating to Recycling and Use of Recycled Plastics

National Research Council Canada

National Building Code of Canada, 1995

¹ American National Standards Institute.

² National Fire Protection Association.

³ American Society for Testing and Materials.

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3.3 Units of measurement

3.3.1 Except as indicated in ~~Clause~~ 3.3.2 the values given in SI (metric) units shall be normative. Any other values given shall be for information purposes only.

3.3.2 For tubing sizes in this Standard, the metric designator is given first followed by the trade size in parentheses.

4 Construction

4.1 Compounds

4.1.1 The material used for ENT shall be rigid (nonplasticized) polyvinyl chloride (PVC). Mechanically attached fittings shall be produced from a material having a minimum relative thermal index (RTI) of 90°C (194°F) for electrical properties and for mechanical without impact properties as described in UL 746B and CAN/CSA-C22.2 No. 0.17.

In Mexico, the requirements in 4.1.1 do not apply.

4.1.2 Clean rework compound, generated from the manufacturer's own production and reused by the manufacturer, meets the intent of these requirements when the finished product complies with all of the requirements of this Standard.

4.1.3 Clean industrial scrap (~~as defined in ASTM D 5033~~) that is not commingled with other plastic materials and originates from a single manufacturing process shall be permitted to be used if:

- a) each source has been qualified in accordance with the requirements of UL 746D or CAN/CSA-C22.2 No. 0.17; and
- b) the tubing and fittings produced meet all the requirements of this Standard.

Note: *This clause excludes the use of reconstituted, recovered, or post-consumer materials.*

In Mexico, the requirements in 4.1.3 do not apply.

4.1.4 When ENT is used in attics, the ENT material shall have a relative thermal index (RTI) of 60°C (140°F). The RTI shall apply to electrical and mechanical without impact properties as described in UL 746B or CAN/CSA-C22.2 No. 0.17.

In Mexico, the requirements in 4.1.4 do not apply.

4.2 Physical requirements

4.2.1 Both the inside and outside surface of each length of ENT shall be free from blisters, cracks, or other defects that would interfere with the drawing in, or withdrawing of, insulated wires or cables.

4.2.2 ENT shall be circular in cross-section and both ends shall be cut perpendicular to the ENT's longitudinal axis.

4.3 Dimensions

4.3.1 The dimensions of the various trade sizes of ENT shall be as shown in Table 1 when measured in accordance with ASTM D 2122 or NMX-E-021-CNCP.

4.4 End stops

4.4.1 A fitting shall be provided with an end stop (centering stop for a coupling). The maximum inside diameter of the stop shall not exceed the minimum outside diameter of the ENT.

5 Performance requirements for ENT

5.1 Vertical flame

5.1.1 When subjected to the test in Clause 7.2, samples of ENT shall not burn for more than 10 s. Flaming or glowing particles shall not fall from the specimen at any time during the test. Not more than 25% of the extended portion of the indicator flag shall be burned.

5.1.2 When tested in accordance with the optional flame test in Clause 7.3, samples of ENT shall not exhibit a char length exceeding 1.5 m (60 in).

5.2 Bending

5.2.1 The circular cross-section shall not be distorted by more than 15 % when tested in accordance with Clause 7.4.

5.3 Resistance to deflection

5.3.1 When tested in accordance with Clause 7.5, six samples of each trade size of ENT submitted shall not deflect more than 30%. There shall not be cracking or buckling of the ENT when examined visually.