



UL 486C

STANDARD FOR SAFETY

Splicing Wire Connectors

UL Standard for Safety for Splicing Wire Connectors, UL 486C

Eighth Edition, Dated June 30, 2023

Summary of Topics

This revision of ANSI/UL 486C dated February 21, 2025 includes the following changes in requirements:

- ***Addition of Optional Testing for the Line Side of Service Qualification; [1.1](#), [7.16.1](#), [8.16.1](#), [9.16.1](#), and Annex I***
- ***Flashover Test for Splicing Wire Connectors; [Table 7.5](#)***
- ***Revisions to Clarify Requirements Associated with Copper-Clad Aluminum; [1.3](#), [4.4A](#), [6.2.1](#), [7.1.1](#) – [7.1.3](#), [7.1.5](#) – [7.1.9B](#), [8.2.5](#), [8.2.6](#), [9.1.3.3](#), [9.1.9.4](#), [10.4](#), [10.5](#), [10.7](#), [Table 7.3](#), and [Table 7.3A](#)***
- ***Alternate Information Means in UL 486C; [10.27](#)***
- ***Addition of Footnote to [Table 7.4](#); [2.1.1](#), [2.1.2](#), and [2.1.4](#)***
- ***Replace Annex B with References to UL/CSA/ANCE Standards; [2.1.1](#), [2.1.4](#), [6.3.7](#) and Annex B***
- ***Marking Clarification; [10.4](#) and [10.17](#)***

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The requirements are substantially in accordance with Proposal(s) on this subject dated June 7, 2024 and October 18, 2024.

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This ANSI/UL Standard for Safety consists of the Eighth Edition including revisions through February 21, 2025. The most recent designation of ANSI/UL 486C as an American National Standard (ANSI) occurred on February 21, 2025. 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 486C on January 28, 1992. 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 ULSE standard for Splicing Wire Connectors. It is the fifth edition of NMX-J-548-ANCE, the fifth edition of CSA C22.2 No. 188, and the eighth edition of UL 486C. This edition of NMX-J-548-ANCE supersedes the previous edition published May 5, 2021. This edition of CSA C22.2 No. 188 supersedes the previous edition published on May 5, 2021. This edition of UL 486C supersedes the previous edition published May 5, 2021. This harmonized standard has been jointly revised on February 21, 2025. For this purpose, CSA Group and ULSE are issuing revision pages dated February 21, 2025, and ANCE is issuing a new edition dated February 21, 2025.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), the CSA Group, and ULSE. The efforts and support of the Technical Harmonization Committee for Connectors, of the Council on the Harmonization of Electrotechnical Standards of 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 SC 20D – Conectores part of the CT 20 – Conductores from the Comité de Normalización de la Asociación de Normalización y Certificación, A.C., CONANCE, with the collaboration of the connectors manufacturers and users.

This standard was reviewed by the CSA Integrated Committee on Electrical Connectors, 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 CSA 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 the 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 ULSE.

An equivalent standard is a standard that is substantially the same in technical content, except as follows: Technical national differences are allowed for codes and governmental regulations as well as 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 word for word except for editorial changes.

Reasons for differences from IEC

The Technical Harmonization Committee identified several IEC standards that address electrical wire connectors included in the scope of this standard. The IEC standards for electrical wire connectors are recognized as being generally system-specific, containing the requirements for the relevant wire connectors and cables in many discrete IEC standards.

The THC determined the safe use of electrical wire connectors is dependent on the design and performance of the wire connectors in relation to the North American electrical codes with which they are intended to be installed. The THC agreed such future investigation would be facilitated by the harmonization of the North American electrical codes for wire connectors with IEC installation practices.

Interpretations

The interpretation by the standards development organization of an identical or equivalent standard is 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.

1 Scope

1.1 This Standard applies to single-polarity, hand-, or tool-applied splicing wire and cable connectors intended for use with all alloys of copper, aluminum conductors, or copper-clad aluminum conductors, or all three, in accordance with the Canadian Electrical Code Part I, CSA C22.1, in Canada, the National Electrical Code, NFPA-70, in the United States of America, or the Standard for Electrical Installations, NOM-001-SEDE, in Mexico, as follows:

Note: Copper-clad aluminum conductors are for use only in the United States in accordance with the National Electrical Code, NFPA 70.

- a) Connectors intended to hold two or more conductor(s);
- b) Connectors intended for use in appliances and equipment that comply with the requirements for such appliances and equipment;
- c) Connectors intended for use with 6 AWG (13.3 mm²) or smaller conductors;
- d) Uninsulated connectors that are used in circuits rated 8 000 V and less;
- e) Connectors intended for use in air-handling spaces;
- f) Exothermically welded wire connectors; and
- g) Splices and taps installed on service conductors.

Note: Examples of splicing wire connectors include twist-on connectors, insulation-piercing or displacement connectors, spring-action connectors, tool-applied crimp, mechanical set-screw connectors, etc.

1.2 This Standard is intended for splicing wire connectors suitable for use with conductors in the size ranges as follows:

- a) Aluminum:
 - 1) 12 AWG (3.3 mm²) and 10 AWG (5.3 mm²) solid;
 - 2) 12 AWG (3.3 mm²) to 6 AWG (13.3 mm²) stranded, Class B concentric, compressed, and compact; and
 - 3) 12 AWG (3.3 mm²) to 6 AWG (13.3 mm²) stranded single input wire (SIW).

In Mexico, the use of aluminum conductors is permitted only with thermoset insulation and for sizes of 6 AWG (13.3 mm²) and higher.

- b) Copper-clad aluminum:
 - 1) In Canada, this construction is not allowed.
 - 2) In Mexico, this construction is not allowed.
 - 3) In the United States:
 - i) 12 AWG (3.3 mm²) and 10 AWG (5.3 mm²) solid; and
 - ii) 12 AWG (3.3 mm²) to 6 AWG (13.3 mm²) stranded, Class B concentric, compressed, and Class C concentric.

- c) Copper:

1) 30 AWG (0.05 mm²) to 10 AWG (5.3 mm²) solid; and

2) 30 AWG (0.05 mm²) to 6 AWG (13.3 mm²) stranded, Class B concentric and compressed, and Class C concentric.

d) Compact-stranded copper conductors:

In Canada and Mexico, for 8 AWG (8.4 mm²) and 6 AWG (13.3 mm²).

In the United States this is not applicable.

e) Rigid (solid and stranded) metric wire sizes, Classes 1, 2, 5, and 6, in the range of 0.5 – 10 mm², in addition to AWG sizes, with AWG ratings mandatory and metric wire ratings optional.

Note 1: Metric wire sizes are based on the IEC Standard for Conductors of Insulated Cables, IEC 60228.

Note 2: For example, a connector rated for 6 AWG (13.3 mm²) – 14 AWG (2.1 mm²) may be additionally rated for 10 – 2.5 mm². See Annex C for example.

f) Other class and strand configurations as indicated by marking.

1.3 Deleted

1.4 This Standard is intended for splicing wire connectors suitable for currents not exceeding the ampacity of insulated conductors rated 75 °C or 90 °C, in accordance with the rating of the connector.

1.5 This Standard does not apply to:

- a) Insulated splicing wire connectors intended for use at voltage levels in excess of 2 000;
- b) Terminal wire connectors;
- c) Wire binding screw terminals;
- d) Built-in terminal connectors on devices rated less than 30 A and intended for outlet box mounting or having provision for stress relief;
- e) Built-in terminal connectors on devices having integral cable clamps;
- f) Flat quick connect terminals; and
- g) Soldering lugs.

2 Reference publications

2.1 Normative references

Where reference is made to any Standards, such reference shall be considered to refer to the latest editions and revisions thereto available at the time of printing, unless otherwise specified.

2.1.1 ANCE Standards

NMX-J-192-ANCE, *Wires and Cables – Flame Test on Electrical Cables – Test Methods*

NMX-J-417-ANCE, *Wires and Cables – Forced-Convection Air Ovens for Evaluation of Polymeric Materials Used in Cables, Electrical Equipment and Devices – Specifications*

NMX-J-508-ANCE, *Wiring Devices – Safety Requirements – Specifications and Test Methods*

NMX-J-543-ANCE, *Wire Connectors*

NMX-J-565/3-ANCE, *Safety Requirements – Flammability of Plastic Materials for Parts in Devices and Appliances – Test Methods*

2.1.2 CSA Standards

C22.1, *Canadian Electrical Code, Part I(CE Code)*

C22.2 No. 0, *General-requirements – Canadian Electrical Code, Part II*

C22.2 No. 0.17, *Evaluation of Properties of Polymeric Materials*

CSA-C22.2 No. 65, *Wire Connectors*

2.1.3 IEC† Standards

IEC 60228, *Conductors of Insulated Cables*

† *International Electrotechnical Commission*

2.1.4 UL Standards

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

UL 486A-486B, *Wire Connectors*

UL 746C, *Polymeric Materials – Use in Electrical Equipment Evaluations*

UL 2043, *Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*

2.1.5 NFPA* Standards

NFPA 70, *National Electrical Code (NEC)*

NFPA 90A, *Installation of Air-Conditioning and Ventilating Systems*

* National Fire Protection Association

2.1.6 NOM Standards – Mexican Secretary of Energy

NOM-001-SEDE, *Standard for Electrical Installations*

2.1.7 ULC Standards

ULC/ORD-C2043, *Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces*

2.1.8 Other Codes

International Mechanical Code

Uniform Mechanical Code

2.2 Informative references

2.2.1 See Annex A for a listing of supplemental standards.

3 Units of measure

3.1 The values given in SI (metric) units shall be normative, except for AWG conductor sizes. Any other values given are for information purposes only.

3.2 For conductor sizes, AWG conductor sizes are noted with their metric equivalents in parenthesis, followed by the closest metric conductor size covered by the IEC Standard for Conductors of Insulated cables, IEC 60228.

Note 1: Specifications for conductor sizes for both AWG and metric are shown as follows: 12 – 6 AWG (3.31 – 13.3) / 4.0 – 10.0 mm².

Note 2: IEC 60228 covers conductors in the metric range of 0.5 – 2 500 mm². For requirements covering AWG wire ranges outside this scope, the specification for the metric conductor will be limited to the conductor range covered by IEC 60228.

4 Definitions

For the purpose of this Standard, the following terms and definitions apply.

4.1 Circular Mil (Cmil) – the area of a circle with a diameter of 0.001 in.

4.2 Control Conductor – an unbroken conductor that is included in the current-cycling test loop.

4.3 Crimping Die – that part of a crimping tool which forms the crimp(s) and usually incorporates the crimp anvil(s), the crimp indenter(s), and the positioner.

Note: Crimping dies may have a separate or integral section for compressing the insulation grip, if provided.

4.4 Equalizer – a busbar that provides for equipotential and uniform current flow in a stranded conductor without adversely affecting the temperature of the connector(s).

4.4A Intermixed – Describes different conductor material types (i.e., copper vs. copper-clad aluminum vs. aluminum) that are in direct physical contact.

Note: For clarity, this Standard states “intermixed and in direct physical contact” for those combination of conductor types that are permitted to be intermixed.

4.5 Packaging Container – the container in which the unit containers are packaged.

4.6 Single Input Wire (SIW) – a stranded conductor that varies the number of wires within a range of conductor sizes in order to permit that range of conductor sizes to be constructed from a single wire size.

4.7 Splicing Wire Connector – a connector that establishes a connection between two or more conductors by means of mechanical pressure and is not intended to be permanently mounted.

4.8 Stability Factor S – the measure of temperature stability of a connector during the current-cycling test.

4.9 Temperature Rating – the maximum temperature of an insulated connector assigned by the manufacturer.

4.10 Temperature Rise – the difference of the temperature of the connector, measured under load, and the ambient temperature.

4.11 Unit Container – the smallest container in which connectors are packaged.

4.12 Voltage Rating – the maximum voltage of an insulated connector.

5 Symbols and abbreviations

5.1 ° – Degree

5.2 A – Amps, Amperes

5.3 Al – Aluminum

5.4 AWG – American Wire Gage/gauge

5.5 C – Celsius

5.6 CC or CCA – Copper-clad aluminum

5.7 Cu – Copper

5.8 d – Days

5.9 f – Flexible

5.10 h – Hour

5.11 HgNO₃ – Mercurous nitrate

5.12 Hz – Hertz, cycles per second

5.13 in – Inches

5.14 m – Meter

5.15 mil – Thousandth of an inch

5.16 min – Minutes

5.17 ml – Milliliter

5.18 mm – Millimeter

5.19 mm² – Square millimeter

5.20 N – Newton – Kilogram meter/sec²

5.21 NH₄ – Ammonia

5.22 r – Rigid solid and rigid stranded

5.23 rpm – Revolutions per minute

5.24 s – Seconds

5.25 SAE – Society of Automotive Engineers

5.26 sol – Solid

5.27 str – Stranded

5.28 V – Volts

6 Construction requirements

6.1 General

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

6.1.2 The design and construction of a connector intended for use with stranded conductors shall be such that all strands of the conductor shall be contained within the connector.

6.1.3 The clamping or twist-on movement of a connector shall adapt it for use with conductors of different sizes, when such use is intended, without permanent removal or addition of parts. Examples of clamping means are:

- a) Direct-bearing screws with or without use of a pressure plate;
- b) Deformation of the connector barrel (crimping) using a special tool;
- c) Element for insulation piercing or insulation displacement;
- d) Spring-action clamp;
- e) Helical coiled spring; and
- f) Formed insulation cavity (no spring).

6.1.4 Any rearrangement or adjustment of a connector that is necessary to adapt it to various sizes of conductors shall be obvious unless the connector is marked as described in [10.11](#).

6.1.5 There shall be no sharp edges or corners on the outer surface of a connector that result in damage to insulation that the connector contacts.

6.2 Intermixing (Intermixed)

6.2.1 Intermixing (direct conductor contact) between conductors of different materials shall be permitted if the connector meets the performance requirements of this Standard and is marked in accordance with [10.5\(e\)](#), [10.5\(h\)](#), and [10.5\(i\)](#).

6.3 Materials

6.3.1 The main current-carrying part of a connector shall be of aluminum, an aluminum alloy, copper, a copper alloy, or other material investigated and found to meet the performance requirements of this Standard.

6.3.2 Except as specified in [6.3.3](#), a connector body of a copper, copper alloy, aluminum, or aluminum alloy and intended for aluminum conductor shall be coated with an electrically conductive coating, such as tin, that will inhibit oxidation and corrosion.

Note: Other coatings may be used if investigated for the purpose and found suitable.

6.3.3 With reference to [6.3.2](#), the following need not be coated:

- a) A connector shipped prefilled with an oxide-inhibiting compound; and
- b) A connector of aluminum or aluminum alloy that is intended for aluminum conductor only.

6.3.4 Iron or steel, if protected against corrosion, may be used for screws, plates, yokes, springs, or other parts that are employed as a means of clamping the conductor, if such parts are not the primary current-carrying members.

6.3.5 Insulation employed as a part of the connector shall be suitable for its rated temperature in accordance with [Table 6.1](#).

Table 6.1
Operating temperature ratings of connector insulation materials

Material	Temperature, °C
Thermoplastic ^a	75
	90
	105
	125
	150
Phenolic ^b	150
Urea ^c	100
Melamine ^d	130
Melamine ^e	150
^a Assigned by the manufacturer.	
^b Composition may be filled or unfilled.	
^c Unless the compound has been found by test to be acceptable for use at a higher temperature.	
^d Composition with a specific gravity less than 1.55.	
^e Composition with a specific gravity 1.55 or more. Compound may have cellulosic filler material.	

6.3.6 Insulation employed as a part of the connector shall be suitable for the tested voltage rating of the connector in accordance with [Table 6.2](#).

Table 6.2
Insulation puncture and flashover test voltages, Tests A and B

Connector insulation voltage rating, V	Test voltage, Vac	
	Puncture (1 min)	Flashover (maximum)
300	2 200	4 000
600 (1 000 in signs and luminaires)	3 400	8 000
1 000	5 000	11 000
1 500	7 000	16 000
2 000	9 000	21 000

6.3.7 The insulating material shall have a minimum flammability classification of V-2 or VTM-2 as determined by tests described in UL 94, CSA C22.2 No. 0.17, or NMX-J-565/3-ANCE. The material thickness for determining the flammability shall be measured at points supporting live parts or within 3 mm (0.118 in) of live parts, whichever is less.

Note: Insulating tubing that has a VW1 rating is not considered equivalent. Tubing may be tested using bar samples to achieve a V-2 minimum rating or the glow wire test (see [6.3.8](#)) may be performed.

6.3.8 With reference to [6.3.7](#), a material other than V-2 or VTM-2 may be used when the insulation of the wire connector complies with the requirements for the glow-wire test as specified in UL 746C, or CSA C22.2 No. 0.17, or NMX-J-508-ANCE, with a glow wire at a temperature of 750 °C.

6.3.9 The insulation color of a twist-on or set-screw connector rated for aluminum conductor shall be purple or brown. The insulation color of a twist-on or set-screw connector rated for copper wire only shall be any color other than purple or brown.

6.3.10 Connectors intended to be installed in air-handling spaces and marked "Suitable for Use in Air-Handling Spaces," or equivalent, as indicated in [10.25](#), shall comply with System Flammability – Discrete Components Located In Air-Handling Spaces, [7.15](#).

7 Test requirements

7.1 General

7.1.1 A connector shall meet the test requirements when separate specimen sets using each conductor type for which the connector is intended (copper, copper-clad aluminum, and aluminum), as specified in [Table 7.3A](#), are subjected to the tests in [Table 7.1](#) and [Table 7.2](#), as applicable, for the design of the connector and with specific modifications noted below:

- A connector of copper or copper alloy need not be subjected to the current-cycling test using copper conductors, unless the connector is dependent upon insulation piercing, insulation displacement, or spring action.
- A twist-on connector provided with a metal insert need not be subjected to the current-cycling test using copper conductors. A twist-on connector not provided with a metal spring shall be subjected to the current-cycling test.
- The initial static-heating test need not be conducted in the static-heating sequence using copper conductors.
- Conductor-sizes 30 – 20 AWG (0.05 – 0.52 mm²) need not be subjected to the secureness test in the static-heating sequence or mechanical sequence.

e) A pre-filled twist-on connector, with or without a spring insert, shall also be subjected to the current-cycling test using copper conductors.

Note: Pre-filling usually consists of a gel, epoxy, antioxidant, or similar compound.

f) Any conductor material may be used for the dielectric voltage-withstand test sequence.

g) If a connector is rated for copper to copper, aluminum to aluminum, and copper to aluminum (intermixed), the mechanical sequence with copper to aluminum conductor may be omitted.

h) In all test sequences, with the exception of [7.1.1\(i\)\(3\)](#), aluminum conductor represents tests with copper-clad aluminum conductor.

i) For a connector intended for the intermixing of copper and aluminum (marked "AL-CU (intermixed and dry locations)" – (i)(1), copper-clad aluminum and copper (marked "CC-CU (intermixed and dry locations)" – (i)(2), or copper-clad aluminum and aluminum (marked "CC-AL (intermixed and dry locations)" – (i)(3), the heat-cycling tests shall be conducted using the following conductor materials:

1) For copper to aluminum (also covers copper-clad aluminum to aluminum):

i) Maximum size copper with maximum size aluminum;

ii) Maximum size copper with minimum size aluminum;

iii) Minimum size copper with minimum size aluminum; and

iv) Maximum size copper in combination with a minimum size aluminum, or conductors where the sum of the test currents of the minimum size conductors is approximately equal to the current of the maximum size conductor.

2) For copper to copper-clad aluminum:

i) Maximum size copper with maximum size copper-clad aluminum;

ii) Maximum size copper with minimum size copper-clad aluminum;

iii) Minimum size copper with minimum size copper-clad aluminum; and

iv) Maximum size copper in combination with a minimum size copper-clad aluminum, or conductors where the sum of the test currents of the minimum size conductors is approximately equal to the current of the maximum size conductor.

3) For copper-clad aluminum to aluminum (does not cover copper to aluminum):

i) Maximum size copper-clad aluminum with maximum size aluminum;

ii) Maximum size copper-clad aluminum with minimum size aluminum;

iii) Minimum size copper-clad aluminum with minimum size aluminum; and

iv) Maximum size copper-clad aluminum in combination with a minimum size aluminum, or conductors where the sum of test currents of the minimum size conductors is approximately equal to the current of the maximum size conductor.

The test currents are based on the lesser current dictated by the two different conductor materials.

j) In addition to the tests specified in [7.1.1\(i\)](#), when the connector is intended for the intermixing or direct contact of:

- 1) Two or more aluminum conductors in combination with one or more copper conductors in the same wire opening, or
- 2) Two or more copper-clad aluminum conductors in combination with one or more copper conductors in the same wire opening,

additional current cycling and static-heating sequences shall be conducted with the test current flowing from aluminum to aluminum or from copper-clad aluminum to copper-clad aluminum. The copper conductor shall not conduct current, but shall only be used to assemble the specified wire combination. The test currents shall be based on the aluminum or copper-clad aluminum test current values specified in [Table 7.4](#). The following combinations shall be tested:

- 1) Maximum size aluminum or copper-clad aluminum (2 conductors) with maximum size copper (1 conductor);
- 2) Maximum size aluminum or copper-clad aluminum (2 conductors) with minimum size copper (1 conductor);
- 3) Minimum size aluminum or copper-clad aluminum (2 conductors) with maximum size copper (1 conductor); and
- 4) Minimum size aluminum or copper-clad aluminum (2 conductors) with minimum size copper (1 conductor).

Table 7.1
Test sequences – all connectors

Clause	Test
9.2	Current cycling
9.3.1 9.3.2 9.3.3 9.3.4	Static-heating sequence – Static heating – Secureness – Repeated static heating – Pullout
9.4.1 9.4.2	Mechanical sequence – Secureness – Pullout
9.10	Stress corrosion/moist ammonia NH_4
9.11	Stress corrosion/mercurous nitrate (HgNO_3)
9.12.1 9.12.2 9.12.3	Spring-action clamp sequence – Conditioning – Temperature – Dielectric withstand
9.13	Over-torque

Table 7.2
Additional test sequences for insulated connectors or connectors employing insulating covers

Clause	Test
9.5	Dielectric withstand
9.6	Secureness of insulation
9.7	Flexing
9.8	Installation at low temperature
9.9	Moisture absorption

7.1.2 Deleted

7.1.3 Deleted

7.1.4 For the current-cycling, static-heating sequence, and mechanical sequence tests, when more than a single conductor is secured by a single securing means, tests on duplicate specimens shall be conducted to represent the most severe conductor position conditions that could result when conductors are assembled into the connector.

7.1.5 Deleted

7.1.6 Deleted

7.1.7 Deleted

7.1.8 Deleted

7.1.9 Deleted

7.1.9A For a tool-applied crimp-on connector, when the conductors are secured by a single securing means, tests shall be conducted with the conductors pre-twisted according to the instructions provided by the manufacturer and according to [10.12](#)(d) and [10.18](#). The conductors shall not be required to be pre-twisted when the design of the connector does not lend itself to direct contact, such as a butt-end splice.

7.1.9B At the manufacturer's option, tests of connectors intended for original equipment manufacturer (OEM) use may be conducted with the conductors not pre-twisted. However, instructions for pre-twisting the conductors shall be provided for field-wiring applications. Instructions for pre-twisting shall be optional for OEM wiring applications. If the connector can be crimped without providing direct contact between the conductors, then tests shall be conducted with the connector crimped so they are not in direct contact. Connectors tested with the conductors not pre-twisted shall be marked as specified in [10.19](#).

7.1.10 Specimen sets shall be subjected to the test sequences using the conductor material specified in [Table 7.3A](#) for the one or more conductor material combinations for which the connector is intended. The dielectric withstand, stress corrosion, secureness of insulation, flexing, and low temperature installation tests may be conducted using either copper or aluminum or copper-clad aluminum conductor. When a connector is rated for copper-to-copper, aluminum-to-aluminum, and copper-to-aluminum (intermixed), or copper-clad aluminum, the mechanical sequence with copper-to-aluminum conductors may be omitted.

Table 7.3
Conductor material to be used in test sequences
Table deleted

Table 7.3A
Conductor material to be used in test sequences and suitable combinations based on markings

Marking (or equivalent)	Conductor used in test sequences	Type of conductor suitable for use with	
		Single conductor in an opening	Two or more conductors in an opening
"CU"	Copper	Copper	Copper to copper
"AL"	Aluminum	Aluminum	Aluminum to aluminum
"CC"	Copper-clad aluminum	Copper-clad aluminum	Copper-clad aluminum to copper-clad aluminum
"AL-CU" or "CU-AL"	Copper and aluminum	Copper Aluminum Copper-clad aluminum	Copper to copper, Aluminum to aluminum, Copper-clad aluminum to copper-clad aluminum,
"CC-CU" for single conductor in an opening or "CC-CU (intermixed – dry locations)" for two or more conductors in an opening	Copper and copper-clad aluminum	Copper Copper-clad aluminum	Copper-clad aluminum to copper-clad aluminum, Copper to copper-clad aluminum (intermixed and in direct physical contact)
"CC-AL" for single conductor in an opening or "CC-AL (intermixed – dry locations)" for two or more conductors in an opening	Copper-clad aluminum and aluminum	Copper-clad aluminum Aluminum	Copper-clad aluminum to copper-clad aluminum, Copper-clad aluminum to aluminum (intermixed and in direct physical contact)
"AL-CU" for single conductor in an opening or "AL-CU (intermixed – dry locations)" for two or more conductors in an opening	Copper and aluminum	Copper Copper-clad Aluminum Aluminum	Copper to copper, Aluminum to aluminum, Copper to aluminum (intermixed and in direct physical contact), Copper-clad aluminum to copper-clad aluminum, Copper to copper-clad aluminum (intermixed and in direct physical contact), Aluminum to copper-clad aluminum (intermixed and in direct physical contact)

7.1.11 Testing may be conducted using AWG solid and stranded sized conductors or Class 1 (rigid solid) and Class 2 (rigid stranded) metric sized conductors as follows:

- AWG solid conductors is representative of Class 1 metric conductors.
- Class 1 metric conductors is representative of AWG solid conductors.
- AWG stranded conductors is representative of Class 2 metric conductors.
- Class 2 metric conductors is representative of AWG stranded conductors.

Representative testing covers conductor sizes within the cross-sectional area envelope, as determined by the circular mils of the conductor, of the conductor sizes used as test conductors. Reference [9.1.5.5](#) – [9.1.5.6](#) for AWG stranding classes. Reference Annex [H](#) for conductor area, in circular mils, for conductor stranding, and for conductor diameters, of both AWG and metric conductor sizes.

Note: See Annex [D](#) for example.

7.1.12 A connector rated for Class 5, Class 6, or both Class 5 and 6 metric conductors (flexible stranded) shall be subjected to all test sequences using the appropriate Class of flexible metric conductors based on the ratings specified by the manufacturer. See [9.1.5.6](#) for testing with specific stranding counts.

7.1.13 Tests conducted on a connector with compact-stranded copper conductors shall be considered representative of concentric and compressed stranded copper conductors of the same size. Tests conducted on a connector with compact, compressed, or concentric-stranded aluminum conductors shall represent tests with compact, concentric, and compressed stranded aluminum conductors of the same size. See [Table 9.1](#).

7.2 Current cycling

7.2.1 The specimen sets shall complete 500 continuous cycles of current-on and current-off operations, while carrying the 60 Hz test current corresponding to the conductor size as specified in [Table 7.4](#). Other than as noted in [9.2.3](#), each cycle of operation shall consist of 1 h on and 1 h off.

Note: A current source may be maintained at or above the required value by regulation or frequent adjustment.