UL 62

STANDARD FOR SAFETY

Flexible Cords and Cables

UL Standard for Safety for Flexible Cords and Cables, UL 62

Twentieth Edition, Dated July 6, 2018

Summary of Topics

This revision of ANSI/UL 62 dated January 31, 2023 is being issued to update the title page to reflect the most recent designation as a Reaffirmed American National Standard (ANS). No technical changes have been made.

As noted in the Commitment for Amendments statement located on the back side of the title page, UL, CSA, and ANCE are committed to updating this harmonized standard jointly. However, the revision dated January 31, 2023 will not be jointly issued by UL, CSA, and ANCE as these revision pages only address UL ANSI approval dates.

Text that has been changed in any manner or impacted by UL's electronic publishing system is marked with a vertical line in the margin.

The requirements are substantially in accordance with Proposal(s) on this subject dated November 11, 2022.

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Association of Standardization and Certification
NMX-J-436-ANCE-2018
Sixth Edition

CSA Group
CAN/CSA C22.2 No. 49-18
Fifteenth Edition

Underwriters Laboratories Inc.
UL 62
Twentieth Edition

Flexible Cords and Cables

July 6, 2018

(Title Page Reprinted: January 31, 2023)

Approved American National Standard

ANSI/UL 62-2018 (R2023)

Commitment for Amendments

This standard is issued jointly by the Association of Standardization and Certification (ANCE), the Canadian Standards Association (operating as “CSA Group”), and Underwriters Laboratories Inc. (UL). Comments or proposals for revisions on any part of the standard may be submitted to ANCE, CSA Group, or UL at anytime. Revisions to this standard will be made only after processing according to the standards development procedures of ANCE, CSA Group, and UL. CSA Group and UL will issue revisions to this standard by means of a new edition or revised or additional pages bearing their date of issue. ANCE will incorporate the same revisions into a new edition of the standard bearing the same date of issue as the CSA Group and UL pages.

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This Standard is subject to review within five years from the date of publication, and suggestions for its improvement will be referred to the appropriate committee. To submit a proposal for change, please send the following information to inquiries@csagroup.org and include "Proposal for change" in the subject line: Standard designation (number); relevant clause, table and/or figure number; wording of the proposed change; and rationale for the change.

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This ANSI/UL Standard for Safety consists of the Twentieth Edition including revisions through January 31, 2023. The most recent designation of ANSI/UL 62 as a Reaffirmed American National Standard (ANS) occurred on January 31, 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 62 on November 6, 1987. The publication of revised pages or a new edition of this Standard will not invalidate the DoD adoption.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at https://csds.ul.com.

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CONTENTS

No Text on This Page

PREFACE

This is the harmonized ANCE, CSA Group, and UL standard for flexible cords and cables. It is the sixth edition of NMX-J-436-ANCE, the fifteenth edition of CAN/CSA-C22.2 No. 49, and the twentieth edition of UL 62. This edition of CAN/CSA C22.2 No. 49 supersedes the previous edition(s) published in 2014, 2010, 2006, 1998, 1992, 1989, 1988, 1981, 1973, 1962, 1960, 1956, 1941, and 1937. This edition of UL 62 supersedes the previous edition published in 2014.

This harmonized standard was prepared by the Association of Standardization and Certification (ANCE), CSA Group, and Underwriters Laboratories Inc. (UL). The efforts and support of the Technical Harmonization Subcommittee, Flex Cords, THSC 20, 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 CT 20 – Conductores from the Comite de Normalizacion de la Asociacion de Normalizacion y Certificacion, A.C., CONANCE, with the collaboration of the wire and cables manufacturers and users.

This standard was reviewed by the CSA Integrated Committee on Flexible Cords/Equipment and Appliance Wires and Cables, 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 UL.

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

This standard provides requirements for insulated cords and cables in accordance with the codes of Canada, Mexico, and the United States. At present there is no IEC standard for cords and cables for use in accordance with these codes. Therefore, this standard does not employ any IEC standard for base requirements.

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 General

This standard specifies the requirements for flexible cords, elevator cables, and hoistway cables rated 600 V maximum and electric vehicle cables rated 1000 V maximum and intended for use in accordance with CAN/CSA C22.1, *Canadian Electrical Code*, *Part I*, in Canada, NOM-001-SEDE, *La Norma de Instalaciones Electricas*, in Mexico, and NFPA 70, *National Electrical Code* (NEC), in the United States.

1.2 Products included

This standard covers the following products:

a) Service cords;

b) Elevator cables;

c) Hoistway cables;

d) Heater cords;

e) Range and dryer cords;

f) Cords for decorative lighting;

g) Tinsel and lamp cords;

h) Special use cords; and

i) Electric vehicle cables.

1.3 National differences

In cases where product types are not approved in all three countries, a national difference is indicated by superscripts, as shown below:

Superscript letter	National difference*
c	For use in Canada only
m	For use in Mexico only
u	For use in United States only
c,m	For use in Canada and Mexico only
c,u	For use in Canada and United States only
m,u	For use in Mexico and United States only

* See Annex D for products recognized by their respective countries.

2 Reference publications

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.

ANCE (Association of Standardization and Certification)

NMX-J-008-ANCE
Wires and Cables – Tinned Soft or Annealed Copper Wire for Electrical Purposes – Specifications

NMX-J-036-ANCE
Wires and Cables – Soft or Annealed Copper Wire for Electrical Purposes – Specifications

NMX-J-040-ANCE
Wires and Cables – Determination of the Moisture Absorption in Insulations of Electrical Conductors – Test Method

NMX-J-066-ANCE
Wires and Cables – Determination of the Diameter of Electrical Conductors – Test Method

NMX-J-177-ANCE
Wires and Cables – Determination of the Thicknesses in Semiconducting Shields, Insulations and Jackets of Electrical Conductors – Test Method

NMX-J-178-ANCE
Wires and Cables – Ultimate Strength and Elongation of Insulation, Semiconducting Shields and Jackets of Electrical Conductors – Test Method

NMX-J-190-ANCE
Wires and Cables – Thermal Shock Resistance of PVC Insulations and Protective Coverings of Electrical Conductors – Test Method

NMX-J-191-ANCE
Wire and Cables – Heat Distortion of Insulations And Protective Coverings of Electrical Conductors – Test Method

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

NMX-J-193-ANCE
Wires and Cables – Cold Bend of Insulation and Non Metallic Protective Jackets Used on Insulated Wire and Cable – Test Method

NMX-J-205-ANCE
Wires and Cables – Determination of Dissipation Factor, Ionization Factor, on Insulated Electrical Conductors – Test Methods

NMX-J-212-ANCE
Wires and Cables – Electrical Resistance, Resistivity and Conductivity – Test Method

NMX-J-293-ANCE
Wires and Cables – Dielectric Voltage Withstand – Test Method

NMX-J-294-ANCE
Wires and Cables – Insulation Resistance – Test Method

NMX-J-473-ANCE
Wires and Cables – Spark Test – Test Method

NMX-J-498-ANCE
Wires and Cables – Vertical Tray Flame Test – Test Method

NMX-J-516-ANCE
Wires and Cables – Determination of Direction and Length of Lay for Bare and Insulated Conductors – Test Method

NMX-J-553-ANCE
Wires and Cables – Weather Resistance of Insulation or Jacket of Electrical Conductors – Test Method

NMX-J-556-ANCE
Wires and Cables Test Methods

CSA Group

CAN/CSA C22.1
Canadian Electrical Code, Part I

CAN/CSA C22.2 No. 0
General Requirements – Canadian Electrical Code, Part II

CAN/CSA C22.2 No. 65
Wire connectors

CAN/CSA Z240 RV Series
Recreational vehicles

CAN/CSA C22.2 No. 2556
Wire and cable test methods

UL (Underwriters Laboratories Inc.)

UL 1659
Attachment Plug Blades for Use in Cord Sets and Power-Supply Cords

UL 2556
Wire and Cable Test Methods

(American Society for Testing and Materials)

B3
Standard Specification for Soft or Annealed Copper Wire

B33
Standard Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes

Government of Mexico

NOM-001-SEDE
La Norma de Instalaciones Electricas

NFPA (National Fire Protection Association)

NFPA 70
National Electrical Code

3 Definitions and units of measurement

3.1 Definitions

The following definitions apply in this standard:

Breather tube – an element placed in cords intended to equalize pressure.

Bunch stranding – a group of wires twisted together without a predetermined pattern.

Diameter tape – a measuring tape that is graduated so that the circumference of a cylindrical object is measured and the reading results in the diameter of the object.

Direction of lay – the longitudinal direction, designated as left-hand (counterclockwise) or right-hand (clockwise), in which the wires of a member or units of a conductor run over the top of the member or conductor as they recede from an observer looking along the axis of the member or conductor.

Electric vehicle cable – a cable intended to connect the electric vehicle supply equipment to the electric vehicle.

Elevator travelling cable – a cable intended for use as a flexible connection between an elevator or dumbwaiter car and its hoistway.

Extra-hard-usage cord – a cord intended for use with heavy equipment and for hand-held appliances and tools, classified as the highest grade in mechanical serviceability.

Grounded conductor – a system or circuit conductor that is intentionally grounded.

Grounding conductor – a conductor that is defined in Mexico, in NOM-001-SEDE, and in the United States, in the *NEC*, as "Grounding Conductor, Equipment", and in Canada, in the *Canadian Electrical Code*, as "Bonding conductor".

Hard-usage cord – a cord intended for use with moderately heavy equipment and for hand-held appliances and tools, classified as the medium grade in mechanical serviceability.

Heater cord – a cord intended for connection to equipment that has a heating element.

Hoistway cable – a cable for control and signal applications in an elevator hoistway.

Neutral conductor – a circuit conductor that normally carries current, and is connected to ground (earth) at the main electrical panel. The conductor of a 2-wire circuit connected to the supply neutral point and earth ground is referred to as the "neutral".

Normal vision – vision without any aid other than the examiner’s normal corrective lenses, if any.

Not-for-hard-usage cord – a cord intended for use with light equipment, classified as the lowest grade in mechanical serviceability.

Room temperature – 25 ±10°C (77 ±18°F).

Rope-lay-stranded conductor – a conductor composed of groups of twisted strands having one or more layers.

Thermoplastic – a polymeric-based material that can be repeatedly softened by heating and hardened by cooling, and that in the softened state can be shaped through the application of force.

Thermoplastic elastomer (TPE) – a thermoplastic that complies with the deformation test in Clause 5.1.3 for compound classes 14, 15, 16, 1.9, 1.10, 1.11 and the heat-shock resistance test in Clause 5.1.8 for TPE materials.

Thermoset – a cross-linked polymeric-based material that will not soften to the point of flowing with subsequent application of heat.

Tinsel cord – cords intended for use only in lengths that do not exceed 2.4 m (8 ft) and that are attached either directly or by means of a special type of attachment plug to a portable electric appliance rated at 0.5 A or less.

Ungrounded Conductor – circuit conductor that is not connected to ground.

3.2 Units of measurement

The values given in SI (metric) units shall be normative. Any other values are for information only and put in parentheses.

4 Construction requirements

4.1 General construction requirements

4.1.1 Conductors

4.1.1.1 General

The conductors of all types of cables and cords shall use flexible stranding, except as detailed under specific constructions. All of the circuit conductors in a cable or cord shall be the same size except where the cable contains five or more circuit conductors, or in electric vehicle cables.

4.1.1.2 Material

Conductors shall be of annealed copper in compliance with ASTM B 3 or NMX-J-036-ANCE, or annealed coated copper in compliance with ASTM B 33 or NMX-J-008-ANCE.

4.1.1.3 Size

4.1.1.3.1 The conductor size shall be determined by both items (a) and (b):

a) The cross-sectional area (stranded conductor) or the diameter (solid conductor) shall not exceed the maximum values given in Table 1. The cross-sectional area shall be determined in accordance with the method specified in the test, Cross-sectional area, by diameter method described in CAN/CSA-C22.2 No. 2556, UL 2556, or Annex C of NMX-J-066-ANCE. The diameter shall be determined in accordance with the method specified in the test, Conductor Diameter, described in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J- 066-ANCE.

b) The DC resistance of each uncoated copper or tin-coated copper conductor in a finished cable shall be as specified in Table 4, Table 5, Table 6, and Table 7. A plus tolerance of 2 percent shall be permitted in the case of a conductor in a twisted multiconductor product having a single layer of conductors. For a twisted multiconductor product having more than one layer, a plus tolerance of 3 percent shall be permitted. Compliance shall be determined in accordance with the test, DC resistance, in CAN/CSA C22.2 No. 2556, UL 2556, or NMX-J-212-ANCE. If the results of any measurement in a twisted multiconductor product are not acceptable, the results of referee measurements made by using a straight specimen of the conductor from the cable without the plus tolerance shall be taken as conclusive.

4.1.1.3.2 The individual wires used in a stranded conductor are usually drawn to a specified diameter, which in some cases does not correspond with the diameter of any gauge number. Not all of the individual strands of the completed conductor are required to have the same diameter.

4.1.1.3.3 For DRT[c] cables with circuit conductor sizes 5.26 mm^2 (10 AWG) and larger, reducing the size of the neutral conductor by not more than two AWG gauge sizes from that of the circuit conductor shall be permitted [e.g., for a 5.26 mm^2 (10 AWG) circuit conductor, the neutral may be 3.31 mm^2 (12 AWG)].

4.1.1.4 Joints

4.1.1.4.1 A joint or splice in one of the individual wires of a stranded conductor shall neither increase the diameter nor decrease the strength of the conductor or the individual wire. A joint or splice shall not be made in a stranded conductor as a whole. For rope-lay-stranded conductor construction, the splicing of a stranded member (primary group) as a unit shall be permitted provided that no joints are made closer than two lay lengths apart.

4.1.1.4.2 A joint or splice in a solid conductor shall neither increase the diameter nor decrease the strength of the conductor.

4.1.1.5 Coating

If the conductor and insulation have been shown to be mutually compatible in accordance with Clause 5.2.8, omission of the coating shall be permitted. Otherwise, if a separator is not provided over the conductor, all the individual wires of the conductor shall be separately tinned.

4.1.1.6 Separator

4.1.1.6.1 When the conductor is neither coated nor shown to be mutually compatible with the insulation in accordance with Clause 5.2.8, a separator as described in Clause 4.1.1.6.3 shall be provided over the conductor.

4.1.1.6.2 A separator shall be permitted on other constructions, but is not required.

4.1.1.6.3 A separator, when provided, is not required to cover the conductor completely unless it is required in order to comply with the copper corrosion test specified in Clause 5.2.8. It shall be of a colour contrasting to that of the conductor, except clear or green or green/yellow shall not be permitted. The separator shall consist of:

a) Close spiraling of fine fibrous yarn or tape;

b) Braid of fine fibrous yarn; or

c) Longitudinally applied tape.

4.1.1.7 Stranding

4.1.1.7.1 General

Flexible conductors shall be bunch-stranded or rope-lay-stranded and shall be composed of wires as shown in Table 2, except that conductors 13.3 mm^2 (6 AWG) and larger shall be rope-lay-stranded.

4.1.1.7.2 Lay of strands

4.1.1.7.2.1 The length of lay of rope-stranded and bunch-stranded conductors shall be not greater than the values shown in Table 3, when tested in accordance with the test, Length of Lay (uncovered components), in CAN/CSA C22.2 No. 2556, UL 2556, or NMX-J-516-ANCE. The direction of lay is not specified.

4.1.1.7.2.2 The maximum acceptable length of lay of strands of a 0.325 mm^2 (22 AWG) conductor used in Type CXTW or XTW shall meet the requirements in Table 3 or shall be based on the performance of the finished type in the abrasion and flexing test described in Clauses 5.1.20 and 5.1.21 respectively.

4.1.1.7.2.3 The length of lay of the individual strands comprising each bunch-stranded member in a rope-lay conductor shall be not more than 30 times the overall diameter of the member. The direction of lay of the individual strands comprising each bunch-stranded member is not specified.

4.1.1.7.2.4 For 8.37 mm^2 (8 AWG) and larger conductors with rope-lay-stranded conductors, the conductor shall be laid up as follows:

a) The length of lay of the outer layer of a rope-lay-stranded conductor shall be as specified in Table 3. The length of lay of other layers is not specified.

b) The length of lay of the individual strands comprising each concentric-lay -stranded member in a rope-lay conductor shall be neither less than 8 nor more than 16 times the outside diameter of the member. The direction of lay of the individual strands comprising each concentric-lay-stranded member is not specified. Bunch-stranded members shall be in accordance with Clause 4.1.1.7.2.3.

4.1.1.7.2.5 The length of lay of the wires of a seven-strand conductor shall be not less than 8 nor more than 16 times the overall diameter of the conductor.

4.1.1.7.2.6 Fibrous (nonmetallic) thread(s) may be used within the conductor stranding in a non-integrally jacketed flexible cord. When threads are used, the conductor shall meet the requirements of (a) and (b) below and shall be marked in accordance with Clause 6.2.4(h):

a) Determination of DC resistance in accordance with the test, DC resistance in:

1) CAN/CSA C22.2 No 2556, or

2) UL 2556.

b) Tests shall be conducted in accordance with the secureness, static heating, and heat cycling tests:

1) In the U.S. in accordance with UL 1659.

2) In Canada, in accordance with CAN/CSA C22.2 No. 65.

The construction and arrangement of the threads is not specified.

Note: ***In Mexico, the requirements in Clause 4.1.1.7.2.6 do not apply.***

4.1.1.7.2.7 Fibrous (nonmetallic) thread(s) may be used within the conductor stranding in single conductor decorative cords. When threads are used, the conductor shall meet the requirements of Clause 4.1.1.7.2.6(a) and the finished wire shall be marked in accordance with Clause 6.2.4(h).

Note: ***In Mexico and Canada, Clause 4.1.1.7.2.7 does not apply.***

4.1.1.8 Grounding (bonding) and grounded (neutral) conductors

4.1.1.8.1 When a grounding conductor is incorporated into a flexible cord or cable, it shall be insulated. For Type DRT[c], an uninsulated grounding conductor shall be permitted for sizes 3.31 and 5. 26 mm^2 (12 and 10 AWG) utilizing a seven-strand construction. Grounding conductors for Type DRT[c] utilizing more than 7 strands shall be insulated.

4.1.1.8.2 For flexible cord or cable with conductor sizes 5.26 mm^2 (10 AWG) and smaller, the grounding conductor shall be the same size or larger than the largest circuit conductors, except for Type DRT[c], where a 3.31 mm^2 (12 AWG) grounding conductor may be used with 5.26 mm^2 (10 AWG) circuit conductors.

4.1.1.8.3 For flexible cord or cable with conductor sizes 6.63 mm^2 (9 AWG), the grounding conductor shall be 5.26 mm^2 (10 AWG) or larger.

4.1.1.8.4 For flexible cord or cable with conductor sizes 8.37 – 33.6 mm^2 (8 – 2 AWG), the reduction of the grounding conductor by not more than two AWG or equivalent mm^2 sizes from the largest ungrounded circuit conductor shall be permitted (e.g., a cord having an 8.37 mm^2 (8 AWG) ungrounded circuit conductor may have a minimum 5.26 mm^2 (10 AWG) grounding conductor).

4.1.1.8.5 For electric vehicle cables with conductor sizes larger than 33.6 mm^2 (2 AWG), the grounding conductor shall not be smaller than indicated in Table 62 and may be sectioned.

4.1.1.8.6 A grounded circuit conductor larger (oversized neutral) than the largest ungrounded circuit conductor shall be permitted.

4.1.1.8.7 Type SRD[m,u], SRDE[m,u], and SRDT[m,u] cable sizes 8.37 – 21.2 mm^2 (8 – 4 AWG) may contain either

a) Two or three 8.37 mm^2 (8 AWG) and one 5.26 mm^2 (10 AWG), two or three 13.3 mm^2 (6 AWG) and one 8.37 mm^2 (8 AWG), or two or three 21.2 mm^2 (4 AWG) and one 13.3 mm^2 (6 AWG). In each case, the smaller conductor shall be the one with the grounded-conductor identification specified in Clause 4.1.9.1(a); or

b) Two 8.37 mm^2 (8 AWG) and two 5.26 mm^2 (10 AWG), two 13.3 mm^2 (6 AWG) and two 8.37 mm^2 (8 AWG), or two 21.2 mm^2 (4 AWG) and two 13.3 mm^2 (6 AWG). In each case, one of the two smaller conductors shall bear the grounded conductor identification specified in Clause 4.1.9.1(a) and the other small conductor shall bear the identification as a grounding conductor specified in Clause 4.1.9.1(b).

4.1.2 Insulation

4.1.2.1 General

The classes of insulation materials covered in this standard are shown in Table 8. The insulation shall be applied directly over the conductor or the separator if one is used; if applied in more than one layer of the same insulation grade or combination thereof, adjacent layers shall not be readily separable. The insulation shall be applied concentrically about the conductor, except for parallel cords. Insulation from one of the following three groups – PVC, TPE, or thermoset – may be interchanged within their groups from

classes shown in Table 8 provided that the insulation materials to be substituted are included in the construction tables for use on the same product type.

NOTES

1) Higher temperature rated insulation materials may be substituted when a lower temperature rated insulation material is specified.

2) Due to possible incompatibility, TPE material of the styrenic type is in some cases not suitable for use in cords where direct contact with PVC can occur. A separator is one acceptable means of avoiding direct contact. Other combinations of materials that could be incompatible, if any, have yet to be detected.

4.1.2.2 New materials

Insulation materials that are generically different from those named in the index tables shown in Table 8 shall be evaluated for the requested temperature rating as described in Clause 5.1.13. Investigation of the electrical, mechanical, and physical characteristics of the construction using the new material shall show the new material to be comparable in performance to the materials currently specified for the application.

4.1.3 Covering

4.1.3.1 General

When a covering is used, the requirements of Clauses 4.1.3.2 to 4.1.3.4 apply.

4.1.3.2 Fibrous braids

4.1.3.2.1 A fibrous braid shall be so constructed that the angle of weave between the yarn and the axis of the underlying insulation or assembly is within the range of 35° to 60°, with a minimum coverage of 76 percent when calculated in accordance with the method in Annex A.

4.1.3.2.2 Where two braids are specified, the diameter, D, for calculating the lay angle of the outer braid shall be the diameter over the inner braid.

4.1.3.2.3 Except where indicated otherwise, braids shall be of cotton or synthetic yarn and shall be fabricated on a machine having the same number of ends per carrier throughout. Each end shall consist of the same size, ply, and kind (i.e., soft or glazed).

4.1.3.2.4 Where two or more braids are required for the outer covering, the final or outermost braid shall conform to the requirements of Clauses 4.1.3.2.1 to 4.1.3.2.3; however, these requirements need not apply to inner braids if they are used instead of a tape. The size of yarn of each carrier of an inner braid shall be not less than that used in the outer braid, and the number of carriers of each adjacent braid shall not differ by more than four.

4.1.3.2.5 A braid used as the final outer covering of a wire or cord intended for use in damp places shall be saturated with a moisture-resistant compound, which may be of any desired colour. A coating of lacquer shall be permitted in place of a saturating compound.

4.1.3.3 Tapes

4.1.3.3.1 Tape shall not be used as the final outer covering on flexible cord and shall not be used instead of a braid directly over the conductor assembly of Types E, EO, and ETT elevator cable, but shall be permitted as an inner fibrous covering.

4.1.3.3.2 Tapes for Types E and EO shall be of the rubber-filled woven cloth type and shall be not less than 0.25 mm (0.01 in) in thickness. They shall be applied helically, so as to overlap by at least 3 mm (0.12 in).

4.1.3.4 Nylon covering

An extruded nylon covering applied over the individual insulated conductors of jacketed flexible cords shall have a minimum thickness of 0.05 mm (0.002 in) at any point. It shall comply with the bend test specified in Clause 5.1.9.

4.1.4 Conductor assembly

4.1.4.1 Lay of conductors

4.1.4.1.1 Flexible cords with cabled conductors shall have the individual conductors twisted together with a length of lay not greater than that shown in Table 10. When cords covered in Table 10 have mixed conductor sizes, the lay shall be based on the number of conductors and the largest conductor size found in the cord. Constructions not covered in Table 10 shall have the individual conductors laid up so that the lay shall be not more than 15 times the overall diameter of the conductor assembly. For CXTW[u], CXWT[c], YXTW[u], and TX[c], the lay shall not be more than 30 times the overall diameter of the insulated conductor. For multiple-layer cords, the conductors in each layer shall be twisted, but the lay is not specified, except that in the outer layer the lay shall be not more than 15 times the overall diameter of that layer.

4.1.4.1.2 Length of lay shall be determined in accordance with the test, Length of Lay (covered components), in CAN/CSA C22.2 No. 2556, UL 2556, or NMX-J-516-ANCE.

4.1.4.2 Fillers

If fillers are used, they shall be of suitable material and shall be twisted with the individual conductors to form a compact assembly having an essentially circular cross-section.

4.1.4.3 Binder

The application of a binder, consisting of a braid, tape, or wrap of suitable material over the conductor assembly, shall be permitted.

4.1.5 Shielding

4.1.5.1 A shield shall be permitted over one or more of the circuit conductors or over the entire assembly under the jacket.

4.1.5.2 The shield shall be a braid of copper wires, copper wire wrapped shields, a metallized polyester tape with a drain wire, or a metal tape with or without a drain wire.

4.1.5.3 A braided or wrapped shield shall be composed of 0.013 mm^2 or 0.020 mm^2 (36 AWG or 34 AWG) copper wires for flexible cords with conductors of 5.26 mm^2 (10 AWG) and smaller, and of 0.032 mm^2 or 0.051 mm^2 (32 AWG or 30 AWG) copper wires for flexible cords with conductors larger than 5.26 mm^2 (10 AWG). If the shield wires and contacting compounds have been shown to be mutually compatible in accordance with Clause 5.2.8, bare copper wires shall be permitted. Otherwise, if a separator is not provided, all the individual wires of the shield shall be separately tinned. The braided or wrapped shield shall provide a minimum coverage of 85 percent when calculated in accordance with the test, Calculation of Coverage of Shielding – Annex G, in CAN/CSA C22.2 No. 2556, UL 2556, NMX-J-556-ANCE.

4.1.5.4 A laminated tape of polyester film and aluminum foil shall be applied longitudinally or helically so that it has at least a 1.52 mm (0.060 in) overlap. The total thickness of the tape shall be 0.038 mm (0.0015 in) minimum for flexible cords with conductors 6.63 mm^2 (9 AWG) and smaller and 0.0635 mm (0.0025 in) for flexible cords with conductors 8.37 mm^2 (8 AWG) and larger. The minimum size of drain wire shall be 0.325 mm^2 (22 AWG) seven-strand minimum tinned copper for flexible cords with conductors 2.63 mm^2 (13 AWG) and smaller, 0.519 mm^2 (20 AWG) seven-strand minimum tinned copper for flexible cords with conductors of 3.31 mm^2 to 6.63 mm^2 (12 – 9 AWG), and 0.824 mm^2 (18 AWG) seven-strand minimum tinned copper for flexible cords with conductors of 8.37 mm^2 (8 AWG) and larger. The drain wire shall be in contact with the aluminum.

4.1.5.5 The overall diameters of shielded cords shall comply with the overall diameters in Table 13, plus the additional increase due to the shield.

4.1.5.6 Flexible cords and cables employing shields of different materials or constructions than those described in Clauses 4.1.5.3 and 4.1.5.4 shall be examined and tested in accordance with Clause 5.2.9.

4.1.6 Jackets

4.1.6.1 General

If a jacket is required, the conductor assembly of the cord or cable shall be covered by and properly centred within the jacket. The jacket shall be applied directly to the conductor assembly or binder, if one is used, and shall fill all the spaces, if any, around the conductor assembly.

Jackets with a total thickness of 1.52 mm (0.060 in) and greater may have a reinforcement consisting of an open weave or the like, placed between adjacent layers of the same class, that shall not be readily separable. Jackets with a total thickness of 2.41 mm (0.095 in) and greater may consist of separable or non-separable adjacent layers of the same class. If separable, the outside layer shall be at least 50 percent of the total thickness measured. If applied in more than one layer, both layers shall be of the same class. Adjacent layers shall not be readily separable when the total jacket thickness is less than 2.41 mm (0.095 in).

All jackets shall provide an essentially circular cross-section for the finished cord or cable, except for Type DRT[c], which shall be used with a moulded-on male plug only and for non-integral parallel cords. The classes of jacket provided in this Standard are shown in Table 11.

4.1.6.2 Interchangeable jackets

Jackets in the PVC, TPE, and thermoset groups may be interchanged within their group from classes shown in Table 11 provided that the material to be substituted is included in the construction tables for use on the same product type.

NOTES

1) Higher temperature rated insulation materials may be substituted when a lower temperature rated insulation material is specified.

2) Due to possible incompatibility, TPE material of the styrenic type is in some cases not suitable for use in cords where direct contact with PVC can occur. A separator is one acceptable means of avoiding direct contact. Other combinations of materials that could be incompatible, if any, have yet to be detected.

4.1.6.3 New materials

Jacket materials that are generically different from those named in the index tables shown in Table 11, if selected for use, shall be evaluated for the requested temperature rating as described in Clause 5.1.13.

Investigation of the electrical, mechanical, and physical characteristics of the construction using the new material shall show the new material to be comparable in performance to the materials indicated for the application.

4.1.7 Overall dimensions

4.1.7.1 When the diameter of a round cord or cable is greater than 6.35 mm (0.25 in), diameter measurements may be made using a diameter tape accurate to 0.25 mm (0.01 in). The tape shall be wrapped tightly around the specimen, but not so tight that the specimen is compressed. To determine whether or not a flexible cord complies with the requirement within Table 13, measurements of overall diameter shall be made under the overall braid (if present) at five points, at intervals of approximately 150 mm (6 in) on a 1 m (3 ft) length of finished cord. An arithmetic average of the readings shall be used as the specimen diameter.

4.1.7.2 When there are questions regarding compliance with this standard or when the cord or cable diameter is 6.35 mm (0.25 in) or less, measurements shall be made with dial micrometer or calipers having a resolution of 0.013 mm (0.0005 in) and accurate to 0.025 mm (0.001 in). At any given cross-section, the maximum diameter, minimum diameter, and two additional diameters that bisect the two angles formed by the maximum and minimum diameters shall be measured. The diameter for the cable at that point shall be the average of the four values.

4.1.8 Coiled cords

4.1.8.1 Coiled cords shall comply with the requirements specified for the standard construction and, except as noted in Clause 4.1.8.2, all tests and measurements shall be conducted on specimens obtained from the straight ends at each end of the coiled portion of the cord.

4.1.8.2 The dielectric strength test of Clause 5.2.2 shall be conducted on the entire length of the coiled cord. The mechanical strength test of Clause 5.1.4 shall be conducted on the coiled portion of the cord. The minimum thickness of the jacket on the coiled portion of round cords and the minimum thickness of the insulation and/or jacket on the coiled portion of parallel cords shall be not less than the applicable value given in this standard. See Note (1) of Table 13 for diameters.

4.1.9 Method of distinguishing conductors

4.1.9.1 Conductors shall be distinguished as follows:

a) Grounded (neutral) conductors shall be distinguished by one of the following methods, and these colours shall be restricted to such use:

1) White or grey coloured braid;

2) White or grey coloured insulation; for jacketed cords furnished with appliances, one conductor may be light blue with the other conductors readily distinguishable from white or grey;

3) White or grey coloured separator in integral constructions only;

4) Tinned conductor on integral constructions only; or

5) One or more grooves, ridges, or white stripes on the exterior of integral constructions only.

b) Grounding conductors shall be distinguished by the colour green or a combination of the colours green and yellow. On a grounding conductor coloured green, one or more yellow stripes that cover

no less than 5 percent and not more than 70 percent of the calculated circumference of the finished conductor insulation shall be permitted.

Note: ***Other acceptable methods of colour coding the individual conductors are shown in Annex B.***

4.1.9.2 The use of a thin, non-separable coloured coating of a suitable material that is compatible with the insulation over the surface of the insulation on the individual conductors, in lieu of coloured insulation, shall be permitted.

4.1.9.3 For integral constructions, one conductor shall be distinguishable by physical or visual means (e.g., ridges, grooves, ink printing, insulation colour).

4.1.10 Breather tubes

4.1.10.1 Types STW, STOW, STOOW, SJTW, SJTOW, SJTOOW, SJEW, SJEOW, SJEOOW, SEW, SEOW, and SEOOW flexible cords having conductor sizes 5.26 mm^2, 3.31 mm^2, 2.08 mm^2, 1.65 mm^2, 1.31 mm^2, 1.04 mm^2, or 0.824 mm^2 (10 AWG, 12 AWG, 14 AWG, 15 AWG, 16 AWG, 17 AWG, or 18 AWG) may have a breather tube incorporated in their construction.

4.1.10.2 The flexible cords specified in Clause 4.1.10.1 and having a breather tube shall comply with all of the requirements for the standard construction of these cords, except that the length of lay shall comply with the lay specified for such cords with an additional conductor; the average overall diameter of these cords shall comply with the overall diameters specified for such cords with an additional circuit conductor.

4.1.10.3 The breather tube shall not crack when specimens of the finished cords are subjected to the cold bend and mechanical strength tests specified for these cords.

4.1.11 Support members

4.1.11.1 The incorporation of a supporting member in the centre of the flexible cord assembly shall be permitted. Supporting members of steel, nonmetallic material, fibrous material, or other suitable material shall be permitted.

4.1.11.2 When metal is used, the support member shall consist of a flexible, stranded metal that is insulated with the same grade and thickness of insulation as used on a circuit conductor of the same size as the strength member.

4.1.11.3 The overall jacket shall be marked to show that a metal support member is present (see Clause 6.2.4(c)).

4.1.12 Optical fibre members

4.1.12.1 Types EV, EVE, EVT, EVJ, EVJE, and EVJT may have optical fibre members incorporated in their construction.

4.1.12.2 The flexible cords specified in Clause 4.1.12.1 and having fibre optic members shall comply with all of the requirements for the standard construction of these cords. The optical fibre members shall be cabled with the insulated conductors. See Clause 4.1.4.1.

4.1.12.3 Optical fibre members shall not contain any current-carrying or electrically conductive elements, and may contain nonmetallic strength members.

4.2 Thermoset-insulated cords (including range and dryer cords and special-use cords C^{U} and PD^{U})

4.2.1 General

Clauses 4.2.2 – 4.2.12 set out specific requirements for thermoset-insulated flexible cords except heater cords (see Table 14 – Table 17). See Clause 4.4 for heater cords.

4.2.2 Conductors

Conductors shall comply with Clause 4.1.1.

4.2.3 Insulation

4.2.3.1 The classes, thickness, and required testing of insulation to be used on a particular type shall be as shown in Table 14 – Table 17.

4.2.3.2 The minimum average and minimum thickness at any point shall be determined in accordance with the test, Thickness, in CAN/CSA C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.2.4 Covering

The application of a covering, in accordance with Clause 4.1.3, over the insulation of individual conductors of jacketed cords, shall be permitted.

4.2.5 Conductor assembly

Conductor assembly, fillers, and binders shall be in accordance with Clause 4.1.4.

4.2.6 Shielding

A shield over the assembled conductors, if provided, shall comply with Clause 4.1.5.

4.2.7 Jackets

4.2.7.1 The classes, thicknesses, and required testing of jackets to be used on a particular type shall be as shown in Table 14 – Table 16.

4.2.7.2 The average and minimum thickness of the jacket shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.2.8 Overall fibrous braid on cords with "-B" suffix

An overall braid may be applied over Types SV, SP-1, SP-2, SP-3, SJ, S, NISP-1, and NISP-2. When a braid is applied, the product shall be printed or have a marker tape under the braid in accordance with Clause 6.2.4(d). The braid need not comply with the requirements in Clause 4.1.3.2.

Note: ***In Mexico, these requirements do not apply.***

4.2.9 Overall dimensions

The overall diameter of the finished cord or cable (under the overall braid if present, see Clause 4.2.8) shall conform to Clause 4.1.7, except in the case of shielded constructions, where the provisions of Clause 4.1.5.5 shall apply.

4.2.10 Types SP-1, SP-2, SP-3, NISP-1, and NISP-2 two- or three-conductor (coiled and uncoiled)

These types shall comply with the construction, test, and marking requirements for corresponding integral and non-integral as indicated in Table 14 and Table 15. The construction of Types SP-1, SP-2, and SP-3 shall be such that the insulated (circuit) conductors can be separated readily for any desired distance after removal of the overall braid (if present) when slit at the end and intentionally torn apart. In addition, the grounding conductor of Types SP-1, SP-2, and SP-3 shall be readily separable from the two insulated (circuit) conductors so as to expose the grounding conductor insulation throughout the entire length of the torn section of the cord.

The construction of NISP-1 and NISP-2 shall consist of a separate jacket and conductor insulation (see Figure 1).

4.2.11 Coiled cords

Coiled cords shall comply with Clause 4.1.8.

4.2.12 Method of distinguishing conductors

The method of distinguishing conductors shall comply with Clause 4.1.9.

4.2.13 Cords with an "-R" suffix for use as a power-supply cord on cord-connected portable appliances

Note: ***In Canada and Mexico, these requirements do not apply.***

4.2.13.1 General

Cords marked with the "-R" suffix as indicated in Clause 6.2.4(g) shall comply with the requirements specified for the standard cord construction in addition to those specified in Clauses 4.2.13.2 – 4.2.13.5. Cords marked with "-R" shall be limited to 0.824 – 2.08 mm^2 (18 – 14 AWG), and 300 V.

4.2.13.2 Abrasion test

The finished cord shall be tested in accordance with the test, Abrasion test for "-R" cords, in Clause 5.1.14.

4.2.13.3 Mandrel pinching test

The finished cord shall be tested in accordance with the test, Mandrel pinching test for "-R" cords, in Clause 5.1.16.

4.2.13.4 Mandrel crushing test

The finished cord shall be tested in accordance with the test, Mandrel crushing test for "-R" cords, in Clause 5.1.17.

4.2.13.5 Flexing test

The finished cord shall be tested in accordance with the test, Flexing test for "-R" cords, in Clause 5.1.18.

4.2.13.6 Cord marking

Cords marked in accordance with Clause 6.2.4(g) shall comply with the tests described in Clauses 4.2.13.2 – 4.2.13.5.

4.3 Thermoplastic-insulated cords (including decorative and range and dryer cords)

Note: ***Clause 4.3 includes specific requirements for thermoplastic-insulated cords (see Table 16 and Table 18 – Table 23).***

4.3.1 General

Clauses 4.3.2 – 4.3.14 set out specific requirements for thermoplastic-insulated flexible cords and cables (see Table 16 and Table 18 – Table 23.)

4.3.2 Conductors

Conductors shall comply with Clause 4.1.1.

4.3.3 Insulation

4.3.3.1 The classes, thicknesses, and required testing of insulation to be used on a particular type are shown in Table 16 and Table 18 – Table 23.

4.3.3.2 The minimum average and minimum thickness at any point shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.3.4 Covering

The application of a covering, in accordance with Clause 4.1.3, over the insulation of individual conductors of jacketed cords shall be permitted.

4.3.5 Conductor assembly

Conductor assembly, fillers, and binders shall be in accordance with Clause 4.1.4.

4.3.6 Shielding

A shield over the assembled conductors, if provided, shall comply with Clause 4.1.5.

4.3.7 Jacket

4.3.7.1 The classes, thicknesses, and required testing of jackets used on a particular cord shall be as shown in Table 16 and Table 18 – Table 21.

4.3.7.2 The average and minimum thickness of the jacket shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.3.8 Overall fibrous braid on cords with "-B" suffix

An overall braid may be applied over types SVT, SPT-1, SPT-2, SPT-3, SJT, ST, NISPT-1, NISPT-2, SVE, SPE-1, SPE-2, SPE-3, SJE, SE, NISPE-1, and NISPE-2. When a braid is applied the product shall be printed or have a marker tape under the braid in accordance with Clause 6.2.4(d). The braid need not comply with the requirements in Clause 4.1.3.2.

Note: ***In Mexico, these requirements do not apply.***

4.3.9 Overall dimensions

The overall diameter of the finished cord or cable (under the overall braid if present, see Clause 4.3.8) shall comply with Clause 4.1.7, except in the case of shielded constructions, where the provisions of Clause 4.1.5.5 shall apply.

4.3.10 Integral constructions

4.3.10.1 Types PXT[c], PXWT[c], XTW[u], and two-conductor SPT-0[m], SPT-1W[c], SPT-2W[c], SPT-1, SPE-1[u], SPT-2, SPE-2[u], SPT-3 , SPE-3[u], DPTW[c,u], DPT[c,u], and clock cord[u] shall be of an integral construction and shall be such that the two insulated conductors can be separated readily for any distance after removal of the overall braid (if present) only when slit at the end and intentionally torn apart (see Figure 2).

4.3.10.2 Three-conductor Type SPT-3 and SPE-3 shall consist of the integral construction, except that they shall have centrally located, non-integral grounding conductors of the same size as the other conductors. Three-conductor Types SPT-1, SPE-1, SPT-2, and SPE-2 shall consist of the integral construction, except that a centrally located non-integral grounding conductor of the same size as the other conductors shall be permitted (see Figure 3 and Figure 4). The grounding conductor shall be provided with an insulation of green with or without yellow stripe(s) (see Clause 4.1.9.1). The construction of the cord shall be such that the insulated (circuit) conductors can be separated readily for any desired distance after removal of the overall braid (if present) when slit at the end and intentionally torn apart. In addition, the grounding conductor shall be readily separable from the two insulated (circuit) conductors so as to expose the grounding conductor insulation throughout the entire length of the torn section of the cord-distance after removal from the braid (if present).

4.3.10.3 The thickness of the insulation on integral cords, before and after separation of the conductors, and the other dimensions of these cords shall be in accordance with Table 16 and Table 18 – Table 23. The thickness shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.3.10.4 For Type SPT-1 cord, a nylon jacket over the finished cord shall be permitted. The average thickness of the nylon, other than on the slopes and the bottoms of the valleys, shall not be less than 0.08 mm (0.003 in). The minimum thickness of the nylon at any point on the slopes and at the bottoms of the valleys shall not be less than 0.03 mm (0.001 in). The finished cord shall comply with the requirements of Clause 5.1.9.

4.3.10.5 The construction and dimensions of three-conductor parallel (integral) Types SRDE[u] and SRDT[u] range and dryer cables shall be as indicated in Figure 5 and Figure 6. When a grounding conductor is used, it shall be the centre conductor (see marking requirements in Clause 6.2.4(e)). For circuit conductors size 8.37 mm^2 (8 AWG) or larger, the grounding conductor may be smaller than the circuit conductors (see Clause 4.1.1.8.4).

4.3.10.6 In Mexico, for Types SPT-0[m], SPT-1, SPT-2 and SPT-3, compliance with the requirements for the FV-2/VW-1 flame test in Clause 5.1.5.4 is mandatory. Compliance with the requirements for the FV-1, FT4 and FH flame tests in Clauses 5.1.5.1, 5.1.5.2, and 5.1.5.3 respectively, is optional.

4.3.11 Types NISPT-1, NISPT-2, NISPE-1, NISPE-2, two- or three-conductor

These types shall comply with the construction, test, and marking requirements for corresponding integral types rated at 60°C, 75°C, 90°C, and 105°C, except that the construction shall involve the use of a separate jacket and conductor insulation (see Figure 1), and the dimension of the insulation, jacket, and web shall be as indicated in Table 18 and Table 19. The insulation and jacket classes shall be as listed in Table 20 and Table 21.

4.3.12 Coiled cords

Coiled cords shall comply with Clause 4.1.8.

4.3.13 Method of distinguishing conductors

The method of distinguishing conductors shall comply with Clause 4.1.9.

4.3.14 Low-leakage flexible cords

4.3.14.1 General

A Type SJT, SJTO, ST, and STO cord that is intended for use as a low-leakage cord in a power-supply cord or cord set for earth-grounded direct-patient-contact medical and dental equipment shall contain two circuit conductors and one grounding conductor, with all conductors having Class 8 or 9 PE insulation or Class 20 FEP insulation.

4.3.14.2 Overall diameter of low-leakage cords

The overall diameter of low-leakage cords shall comply with Table 13, plus the additional increase due to any filler-spacers.

4.3.14.3 AC leakage current test

The finished cord shall be tested in accordance with the AC leakage current test described in Clause 5.2.11 and shall comply with the requirements in Table 24.

4.3.14.4 Marking for low-leakage cords

Low-leakage cords shall be marked in accordance with Clause 6.2.4(f).

4.3.15 Cords with the "-R" suffix for use as a power-supply cord on cord-connected portable appliances

Note: ***In Canada and Mexico, these requirements do not apply.***

4.3.15.1 General

Cords marked with the "-R" suffix as indicated in Clause 6.2.4(g) shall comply with the requirements specified for the standard cord construction in addition to those specified in Clauses 4.2.13.2 – 4.2.13.5. Cords marked with "-R" shall be limited to 0.824 – 2.08 mm^2 (18 – 14 AWG), and 300 Volts.

4.3.16 Decorative cord type CXTW^{u} with Suffix "-IS"

Note: ***In Canada and Mexico, these requirements do not apply.***

4.3.16.1 Decorative cord type CXTW^{u} marked with the suffix "-IS" as indicated in Clause 6.2.4(k) shall comply with the requirements specified for type CXTW^{u} and to those specified in Clauses 4.3.16.2 – 4.3.16.6. The suffix "-IS" is limited for use on single conductor CXTW^{u} cord in 0.325 mm^2 (22 AWG) size.

4.3.16.2 Fibrous (nonmetallic) thread(s) may be embedded within the insulation of a single conductor CXTW^{u} cord. When the threads are embedded in the insulation, the finished wire shall be designated CXTW-IS^{u} and shall be marked in accordance with Clause 6.2.4(k). The overall insulation thickness including the threads shall comply with the requirements for CXTW^{u}. The minimum thickness at any point of insulation over the fibrous threads shall not be less than 0.381 mm (15 mils).

4.3.16.3 Type CXTW-IS^{u} shall be subjected to the Breaking strength test in Clause 5.1.24.

4.3.16.4 Type CXTW-IS^{u} shall be subjected to the Abrasion test in Clause 5.1.20.

4.3.16.5 Type CXTW-IS^{u} shall be subjected to the Flexing test in Clause 5.1.21.

4.3.16.6 Before the sample subjected to the conductor corrosion test (see Clause 5.2.8) is examined for corrosion of the conductor, the insulation of type CXTW-IS^{u} shall be examined for any damage due to the presence of the threads. Damage of the insulation includes, but is not limited to exposure of the conductor, splitting of the insulation or bulging of the insulation.

4.4 Heater cords – HSJOO, HSJOOW, HSJO, HSJW^{c,u}, HSJOW, HSJ, HPN, HPNW^{c,u}, and HPD^{m,u}

Note: ***Clause 4.4 includes specific requirements for heater cords (see Table 25 and Table 26).***

4.4.1 Conductors

4.4.1.1 General

Conductors employed in heater cords shall comply with Clause 4.1.1.

4.4.1.2 Stranding

The individual conductors shall be bunch or rope-lay stranded, consisting of wires having a diameter in accordance with Table 2 and a lay length in accordance with Table 3.

4.4.2 Separator

If the conductor is neither coated nor shown to be compatible with the insulation as determined by the test in Clause 5.2.8, a separator as described in Clause 4.1.1.6 shall be provided over the conductor.

4.4.3 Insulation

4.4.3.1 General

The class of insulation and testing required for a particular type of heater cord is shown in Table 25 and Table 26. The insulation shall be applied directly over the conductor or the separator, if one is used.

4.4.3.2 Types HPN and HPNW^{c,u}

The thickness of insulation, as applicable for use on Types HPN and HPNW^{c,u} cord, before and after separation of the conductor, and the other dimensions of the cord, shall be in accordance with Table 27 for

two-conductor cord and with Table 28 for three-conductor cord. The thickness shall be determined in accordance with the test, Thickness, in CAN/CSA C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.4.3.3 Types HSJOO, HSJOOW, HSJO, HSJOW, HSJ, HSJW[c,u] and HPD[m,u]

The average and minimum thickness of the insulation shall be not less than the values given in Table 29. The thickness shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.4.4 Conductor assembly

4.4.4.1 Types HPN and HPNW[c,u]

Two- and three-conductor Types HPN and HPNW[c,u] cords shall be of integral construction and shall comply with the requirements of Clause 4.4.3.2, except that the insulation on the grounding conductor shall be of a green colour, with or without yellow stripe(s) (see Clause 4.1.9.1). The construction of the cord shall be such that the insulated (circuit) conductors can be separated readily for any desired distance when slit at the end and intentionally torn apart. In addition, the grounding conductor shall be readily separable from the two insulated (circuit) conductors so as to expose the grounding conductor insulation throughout the entire length of the torn section of the cord.

4.4.4.2 Types HSJOO, HSJOOW, HSJO, HSJOW, HSJ, HSJW[c,u], and HPD[m,u]

The individual insulated conductors shall be twisted together with a length of lay not greater than that shown in Table 10. Fillers, if used in the assembly of these cords, shall be twisted with the conductors to form a compact assembly having an essentially circular cross-section.

4.4.4.3 Coiled cords

Coiled cords shall comply with Clause 4.1.8.

4.4.5 Jackets

4.4.5.1 Types HSJOO, HSJOOW, HSJO, HSJOW, HSJ, and HSJW[c,u] cords shall be covered by, and properly centred in, a thermoset jacket of the class specified in Table 25 and Table 26. The jacket shall provide an essentially circular cross-section for the finished cord.

4.4.5.2 The average and minimum thickness of the jacket shall be as indicated in Table 25 and Table 26. The thickness shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.4.6 Cords with an "-R" suffix for use as a power-supply cord on cord-connected portable appliances

Note: ***In Canada and Mexico, these requirements do not apply.***

4.4.6.1 General

Cords marked with the "-R" suffix as indicated in Clause 6.2.4(g) shall comply with the requirements specified for the standard cord construction in addition to those specified in Clauses 4.2.13.2 – 4.2.13.5. Cords marked with "-R" shall be limited to 0.824 – 2.08 mm^2 (18 – 14 AWG), and 300V.

4.5 Tinsel cords (TST, TPT, shaver cord[u])

Note: ***Clause 4.5 includes specific requirements for tinsel cords (see Table 30).***

4.5.1 General

Tinsel cords are a very flexible cord in which each conductor comprises a number of strands or group of strands, twisted together, each strand being composed of one or more flattened wires of copper or copper alloy, helically wound on a thread of cotton, polyamide, or similar material.

4.5.2 Conductors

4.5.2.1 Construction

4.5.2.1.1 The conductors of tinsel cords shall consist of one of the following styles of construction:

a) An assembly of 18 strands, which shall consist of three groups having a rope lay, each group consisting of six strands. Each strand shall consist of a flattened 0.006 mm^2 (39 AWG) annealed copper wire wrapped around a core of No. 30 two ply cotton thread, or equivalent fibrous material;

b) An assembly of six strands, which shall have a rope lay around a centre core of No. 10 three-ply cotton thread, or equivalent. Each strand shall consist of two flattened 0.010 mm^2 (37 AWG) annealed copper wires wrapped around a core of No. 20 three-ply cotton thread, or equivalent;

c) An assembly of seven strands, in the form of six strands having a rope lay about the seventh. Each strand shall consist of two flattened 0.008 mm^2 (38 AWG) annealed copper wires wrapped concentrically around a No. 270 denier polyester thread;

d) An assembly of 18 strands consisting of six groups having a rope lay and each group consisting of three strands. Each strand shall consist of a flattened 0.006 mm^2 (39 AWG) annealed copper wire wrapped around a core of No. 50 two-ply cotton thread, or equivalent;

e) An assembly of seven strands, in the form of six strands having a rope lay about the seventh. Each strand shall consist of two flattened 0.010 mm^2 (37 AWG) cadmium copper wires wrapped concentrically around a core of No. 250 denier polyester fibre thread, or equivalent;

f) An assembly consisting of flattened copper or copper alloy wires having a total cross-sectional area of no less than 0.100 mm^2 (198 cmil). The construction and arrangement of the strands is not specified, but the finished cord shall be acceptable for the purpose, as determined by an investigation that includes a flexibility test.

4.5.2.1.2 A 0.59 mm^2 (20 AWG) or smaller flexible cord having tinsel conductors not complying with Clause 4.5.2.1.1 (a) to (f) or having a stranded copper construction may be used as shaver cord[u] without any type-letter designation if it is acceptable for the purpose as determined by an evaluation that includes:

a) Determination of DC resistance in accordance with the test, DC Resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-212-ANCE; and

b) The Tinsel flexing test, as described in Clause 5.1.19.

4.5.2.2 DC resistance

The DC resistance of each individual (not twisted) finished conductor shall not exceed 0.27 Ω/m (0.08 Ω/ft) at 25°C. Compliance shall be determined in accordance with the test, DC Resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-212-ANCE.

4.5.3 Insulation

4.5.3.1 The classes of insulation and testing required for a particular type are shown in Table 30.

4.5.3.2 For Type TST cords, the average and minimum thickness of the insulation shall be in accordance with Table 30.

4.5.3.3 For Type TPT cords and shaver cords[u], the thickness of insulation before and after separation of the conductors and the thickness of the web shall be in accordance with Table 30.

4.5.3.4 The minimum average and minimum thickness at any point of insulation shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.5.3.5 The application of a covering in accordance with Clause 4.1.3 over the insulation of individual conductors of jacketed cords shall be permitted.

4.5.4 Conductor assembly

4.5.4.1 Type TPT and shaver cords[u]

Type TPT cord and shaver cords[u] shall be of a parallel, integral construction and shall be such that the two insulated conductors can be separated readily for any distance only when slit at the end and intentionally torn apart.

4.5.4.2 Type TST

4.5.4.2.1 The individual conductors shall be twisted together with a length of lay not greater than value indicated in Table 10.

4.5.4.2.2 If fillers are used, they shall be of suitable material and shall be twisted with the individual conductors to form a compact assembly having an essentially circular cross-section.

4.5.4.2.3 A binder consisting of a braid, tape, or wrap of suitable material may be applied over the conductor assembly.

4.5.5 Jacket

4.5.5.1 A jacket in accordance with Table 30 shall be applied directly over the conductor assembly of Type TST cord or the binder, if one is used.

4.5.5.2 The average and minimum thickness of the jacket shall be in accordance with Table 30. The thickness shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.5.6 Coiled cords

Coiled cords shall comply with Clause 4.1.8.

4.5.7 Method of distinguishing conductors

The method of distinguishing conductors shall comply with Clause 4.1.9.

4.6 Elevator travelling cables – Types E, EO, ETT, and ETP

Note: ***Clause 4.6 includes specific requirements for elevator travelling cables (see Table 31).***

4.6.1 Conductors

Conductors shall comply with Clause 4.1.1.

4.6.2 Insulation

4.6.2.1 The classes of insulation and required testing to be used on a particular type are shown in Table 31.

4.6.2.2 Insulation thickness shall be not less than the values shown in Table 32.

4.6.2.3 Insulation shall comply with Clause 4.1.2.

4.6.2.4 The minimum average and minimum thickness at any point shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.6.3 Braids

4.6.3.1 General

Braids shall comply with Clause 4.1.3.2.

4.6.3.2 Conductor braids

A braid shall be applied over the insulation on the individual conductors for Types E and EO. The provision of a conductor braid for Types ETT and ETP is optional.

4.6.3.3 Outer braids

4.6.3.3.1 A braid shall be applied over the twisted conductor assembly for Types E, EO, and ETT, and is optional over the conductor groups found in Type ETP.

4.6.3.3.2 The outer braid on Type E cable shall be saturated with a flame- and moisture-resistant compound. In accordance with Clause 4.1.3.3, a rubber-filled fibrous tape or tapes may be used between the inner and outer braids on Type E cable. The minimum size and ply of yarn and the thickness of the outer braid shall be not less than the values indicated in Table 33.

4.6.4 Conductor assembly

4.6.4.1 Lay of conductors

The individual conductors of Types E, EO, and ETT and the conductor groups of Type ETP shall be twisted together with a length of lay not greater than the values specified in Table 34.

4.6.4.2 Types E, EO, and ETT

The conductors shall be cabled around a core composed of fibrous material, PVC insulated steel wires, fibrous-covered PVC insulated steel wires, or a combination of these materials. PVC insulation on steel

core shall have a minimum average thickness of 0.25 mm (0.010 in). If desired, cabling suitable fillers with the individual insulated conductors shall be permitted.

4.6.4.3 Type ETP

The assembly shall consist of two or more insulated conductors or groups of insulated conductors, laid in parallel to form a flat cable. One or more webs composed of the same material as the jacket shall be permitted. Support members, placed in the centre of the group(s) or in other suitable position(s) and composed of materials as outlined in Clause 4.6.4.2, shall be permitted. When support members are used outside of the group construction, the insulation on steel members is optional, and webs shall be provided between the support members and adjacent conductors or groups.

4.6.4.4 Duplex cables

4.6.4.4.1 General

When required, the incorporation of duplex cables for use as telephone circuits in Types E, EO, ETT, and ETP cables shall be permitted. Each duplex cable shall consist of two insulated conductors not smaller than 0.519 mm^2 (20 AWG), a shield, and a jacket. A cable that consists entirely of twisted pairs shall be permitted.

4.6.4.4.2 Insulation

Each conductor shall be insulated with a material that complies with the physical properties required and meets the insulation thickness for Type SV or SVT cord.

4.6.4.4.3 Assembly of conductors

The insulated conductors shall be twisted together in accordance with Table 34.

4.6.4.4.4 Covering

The application of a covering, in accordance with Clause 4.1.3, shall be permitted.

4.6.4.4.5 Shield

4.6.4.4.5.1 General

A shield consisting of a copper braid or a polyester and aluminum foil laminated tape shall be applied over the twisted conductors.

4.6.4.4.5.2 Braid

Braided shields shall comply with Clause 4.1.5.3. For thermoplastic insulation, the copper braid shall be bare or coated. For thermoset insulation, bare soft copper wires shall be permitted if the shield wires and contacting compounds are compatible in accordance with Clause 5.2.8. Otherwise, if a separator is not provided, all the individual wires of the shield shall be separately tinned.

4.6.4.4.5.3 Tape

Laminated polyester and aluminum foil tape shields shall comply with Clause 4.1.5.4, except that the minimum size of the drain wire shall be 0.519 mm^2 (20 AWG), the minimum thickness of the tape shall be 0.025 mm (0.001 in), and for thermoplastic insulations a coated or uncoated drain wire shall be used.

4.6.4.4.6 Jacket

One of the following shall be applied over the shield:

a) A jacket having a minimum average thickness of 0.38 mm (0.015 in) and a minimum thickness at any point of 0.33 mm (0.013 in) of a compound that meets the physical requirements for the jacket of Type SV, SVO, SVT, or SVTO cord;

b) A nylon covering having a minimum thickness at any point not less than 0.05 mm (0.002 in). In the case of a duplex cable using a bare or tinned copper braided shield, the application of a separator under or over the shield, if desired, shall be permitted; or

c) For Type ETP, when pairs are used and the shields are not in contact with each other or the circuit conductors, the jacket over the shielded pairs is optional, and webs shall be provided between the support members, between pairs, and between adjacent conductors or groups.

4.6.4.5 Coaxial cable

When required, coaxial cable in Types E, EO, ETT, and ETP shall be permitted as follows:

a) A coaxial cable shall consist of a centre conductor, insulation, shield, and an overall covering in accordance with Item (b).

b) The overall covering on the coaxial cable shall be one of the following:

1) PVC with a minimum average thickness of 0.38 mm (0.015 in) and a minimum thickness at any point of 0.33 mm (0.013 in);

2) Two laps of polyester tape, each with a minimum thickness of 0.025 mm (0.001 in);

3) Rayon braid; or

4) A nylon covering having a minimum thickness at any point of 0.05 mm (0.002 in).

4.6.4.6 Optical-fibre component or cable (optional)

Optical fibre members may contain a metallic element.

4.6.5 Shield

An overall shield in accordance with Clause 4.1.5 shall be permitted.

4.6.6 Jacket

4.6.6.1 The class of jacket to be used on a particular type is shown in Table 31. Jackets shall comply with Clause 4.1.6.

4.6.6.2 The average and minimum thickness of jackets shall be in accordance with Table 35 and Table 36.

4.6.6.3 The average and minimum thickness of the jacket shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.6.7 Method of distinguishing conductors

Conductors in Types E and EO cables shall be of readily distinguishable colours.

Conductors in Types ETT and ETP elevator cables shall be coded by one of the following methods:

a) Readily distinguishable colours;

b) Numbers printed in ink on the surface of the insulation; or

c) A combination of colours and number coding.

4.6.8 Flame test

All finished constructions shall be tested in accordance with Clause 5.1.5.1 (FT1).

4.7 Hoistway cables

Note: ***Clause 4.7 includes specific requirements for hoistway cables (see Table 37).***

4.7.1 General

4.7.1.1 These requirements apply to hoistway cables for control and signal applications in elevator hoistways, in accordance with the Rules of the *Canadian Electrical Code, Part I*, the *National Electrical Code*, and *La Norma de Instalaciones Electricas*. These cables have a temperature rating of 60 or 90°C and a voltage rating of 300 or 600 V.

4.7.1.2 Constructions rated at 300 V shall consist of twisted assemblies of 2 to 75 conductors.

4.7.1.3 Constructions rated at 600 V shall consist of twisted assemblies of 2 to 75 conductors or parallel constructions of 2 to 4 conductors.

4.7.1.4 Except for short runs not exceeding 1.5 m (5 ft) in length, the parallel constructions are intended for use in raceways into which the cables are laid.

4.7.2 Construction

4.7.2.1 Parallel construction

The parallel construction shall consist of 2 to 4 solid or stranded 0.824 mm^2 (18 AWG) conductors.

4.7.2.2 Twisted construction

The twisted conductor constructions shall consist of 2 to 75 conductors of the following sizes or combination of sizes:

a) 0.824 mm^2, 1.31 mm^2, 2.08 mm^2, or 3.31 mm^2 (18 AWG, 16 AWG, 14 AWG, or 12 AWG) for 600 V constructions; or

b) 0.519 mm^2, 0.824 mm^2, 1.31 mm^2, 2.08 mm^2, or 3.31 mm^2 (20 AWG, 18 AWG, 16 AWG, 14 AWG, or 12 AWG) for 300 V constructions.

Twisted constructions of telephone conductor pairs, coaxial cables, optical fibre, or any combination thereof shall be permitted. An overall PVC jacket shall be permitted.

4.7.3 Conductors

4.7.3.1 General

Conductors shall comply with Clause 4.1.1.

4.7.3.2 Stranding

4.7.3.2.1 Solid or stranded conductors shall be permitted.

4.7.3.2.2 Stranded conductors shall have not less than seven wires.

4.7.3.2.3 No special combination of the individual wires of a stranded conductor is required, but simple bunching (untwisted wires) shall not be permitted. The lay of a layer of wires in a concentric assembly shall be not less than 8 nor more than 16 times the layer diameter (the overall diameter of that layer). The lay of the wires in bunch-stranded conductors shall be not more than 64 mm (2.50 in).

4.7.4 Insulation

4.7.4.1 The parallel construction shall be such that the insulated conductors can be readily separated for any distance only after being slit at the end and intentionally torn apart. The parallel construction shall be of individual insulated conductors heat-fused or of conductors laid parallel and insulated in one extrusion.

4.7.4.2 The classes of insulation to be used and the required testing shall be as shown in Table 37.

4.7.4.3 Insulation thickness shall not be less than the values shown in Table 38.

4.7.4.4 The average and minimum thickness at any point of insulation shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE. In the case of parallel constructions, the minimum wall thickness at the tear after separation shall be not less than the minimum shown in Table 38.

4.7.4.5 Insulation shall comply with Clause 4.1.2 and the test requirements of Clause 5.

4.7.5 Conductor assembly

4.7.5.1 General

The twisted construction shall have the conductors twisted together with a length of lay not exceeding 915 mm (36 in).

4.7.5.2 Duplex cables – telephone pairs (optional)

Duplex cables shall comply with Clause 4.6.4.4.

4.7.5.3 Coaxial cables (optional)

Coaxial cables shall comply with Clause 4.6.4.5.

4.7.5.4 Optical fibre component or optical fibre cable (optional)

Optical fibre members may be permitted to contain a metallic element.

4.7.5.5 Binder

A suitable binder shall be permitted over the twisted conductor assembly.

4.7.5.6 PVC jacket (optional)

If provided, the classes of jacket to be used and the required testing shall be as shown in Table 37 and shall comply with Clause 4.1.6. The jacket thickness shall not be less than is shown in Table 39. The minimum average and minimum thickness of the jacket shall be determined in accordance with the test, Thickness, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.7.6 Method of distinguishing conductors

The conductors in the twisted and parallel constructions shall be made distinguishable from each other in accordance with Clause 4.1.9.

4.7.7 Marking

Product and package markings shall be in accordance with Clause 6.5.

4.8 Electric vehicle cables

Note: ***Clause 4.8 includes specific requirements for electric vehicle cables (see Table 40).***

4.8.1 General

These cables have a temperature rating of 60 – 105°C dry, 60°C wet, 300, 600 V, or 1000 V, employing oil-resistant and sunlight-resistant jacket and suitable for use in wet locations.

4.8.2 Conductors

Conductors shall comply with Clause 4.1.1.

4.8.3 Insulation

4.8.3.1 Insulation shall be in accordance with Clause 4.1.2. The classes, thickness, and required testing of insulation to be used on a particular type shall be as shown in Table 40. Insulation thickness of signal and communication conductors 0.824 mm^2 (18 AWG) and smaller shall comply with the requirements for 0.824 mm^2 (18 AWG) circuit conductors.

4.8.3.2 The minimum average and minimum thickness at any point shall be determined in accordance with the test Thickness in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177–ANCE.

4.8.4 Covering

The application of a covering, in accordance with Clause 4.1.3, over the insulation of individual conductors, shall be permitted.

4.8.5 Conductor assembly

Conductor assembly, fillers, and binders shall be in accordance with Clause 4.1.4.

When data/signal conductors are assembled with circuit conductors, they shall be cabled in the same direction and with the same length of lay as the circuit conductors. The data/signal conductors may be individual(s) or pairs or groups and either shielded or unshielded and jacketed or unjacketed. The jacket, if present, shall meet the requirements of SV, SVE or SVT.

4.8.6 Shielding

A shield over the assembled conductors, if provided, shall comply with Clause 4.1.5.

4.8.7 Jackets

4.8.7.1 Jackets shall be in accordance with Clause 4.1.6. The classes, thickness, and required testing of jackets to be used on a particular type shall be as shown in Table 40.

4.8.7.2 The jacket on a cable containing at least one conductor larger than 33.6 mm^2 (2 AWG) shall be reinforced by a tape, two servings, or braid of natural or synthetic material. If two servings are used, they shall be applied in opposite directions of lay. The reinforcing layer shall be under the single layer jacket, or between the layers of the two-layered construction. The total jacket thickness shall be in accordance with Table 57 and Table 58.

4.8.7.3 The average and minimum thickness of the jacket shall be determined in accordance with the test Thickness in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-177-ANCE.

4.8.8 Overall dimensions

The overall diameter of the finished cord or cable shall conform to Clause 4.1.7, except Table 13 does not apply.

4.8.9 Coiled cords

Coiled cords shall comply with Clause 4.1.8.

4.8.10 Methods of distinguishing conductors

The method of distinguishing conductors shall comply with Clause 4.1.9.

5 Performance and test requirements

5.1 Physical properties

5.1.1 Insulation

The physical properties of the various classes of insulation, when tested before and after accelerated aging, shall comply with the applicable requirements given in Table 9. Compliance shall be determined in accordance with the test, Physical Properties (ultimate elongation and tensile strength), in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-178-ANCE.

5.1.2 Jackets

The physical properties of the various classes of jackets, when tested before and after accelerated aging, shall comply with the applicable requirements given in Table 12. Compliance shall be determined in accordance with the test, Physical Properties (ultimate elongation and tensile strength), in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-178-ANCE on die-cut samples.

5.1.3 Deformation

5.1.3.1 Insulation

The insulation on single-conductor wires (with nylon and any other covering removed), and on the individual conductors (separated, in the case of parallel cords), shall not decrease by more than 50 percent in thickness when subjected to a force caused by a mass as shown in Table 41, and while maintained at the temperature shown in Table 41 for 1 h.

5.1.3.2 Jacket

Smoothed specimens of jackets from finished cords and cables shall not decrease by more than 50 percent in thickness when subjected to a force caused by a mass of 2000 g (4.4 lbs), and while maintained at the temperature shown in Table 40 for 1 h.

5.1.3.3 Method

Compliance with Clauses 5.1.3.1 and 5.1.3.2 shall be determined in accordance with the test, Deformation, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-191-ANCE. The overall braid, if present, shall be removed.

5.1.4 Mechanical strength

5.1.4.1 General

The mechanical strength of finished jacketed two- or three-conductor 0.824 mm^2 (18 AWG) cords (except NISPT-1, NISPT-2, NISPE-1, NISPE-2, NISP-1, NISP-2, HSJ, HSJW^{c,u}, HSJO, HSJOO, HSJOOW, and HSJOW^{c,u}) after removal from the overall braid (if present) shall be such that no conductor will break when subjected to a force caused by a mass of 68 kg (150 lbs) for 1 min. For two- or three-conductor 1.04 mm^2 (17 AWG) finished cords (except HSJ, HSJW^{c,u}, HSJO, HSJOO, HSJOOW^{c,u}, and HSJOW^{c,u}), after removal from the overall braid (if present), no conductor shall break when subjected to a force caused by a mass of 77 kg (170 lbs) for 1 min. The weight method shall be considered the referee method.

5.1.4.2 Method

Compliance shall be determined in accordance with the test, Mechanical Strength, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-178-ANCE.

5.1.5 Flame tests

5.1.5.1 Vertical flame tests – FT1 or FV-1

Finished cords and cables shall not convey flame, continue to burn for more than 60 s after five 15 s applications of a standard test flame, and in the case of the FV-1 test, drop flaming particles that ignite cotton. Compliance shall be determined in accordance with the test FT1 or the test FV-1, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-192-ANCE. A specimen shall be considered to have conveyed flame

if more than 25 percent of the extended portion of the indicator is burned. In parallel construction, the major diameter shall face the burner.

5.1.5.2 Vertical flame test – FT4

Finished cords or cables shall not have a char length in excess of 1.5 m (59 in). Compliance shall be determined when tested in accordance with the test, Vertical tray flame test (Method 2 – FT4), in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-498-ANCE.

5.1.5.3 Horizontal flame test – FT2 or FH

The length of the charred portion of the specimen of cord shall not exceed 100 mm (3.9 in), nor shall flaming particles ignite cotton. Compliance shall be determined when tested in accordance with the test, FT2/FH/Horizontal Flame, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-192-ANCE. In parallel constructions, the major diameter shall be in the vertical plane for testing. For non-jacketed constructions, the finished product shall be tested, and the greatest char length on any conductor shall be the char length measured.

5.1.5.4 Vertical flame test – VW-1 or FV-2

When the finished cable and the finished individual insulated conductors (including any nylon or other covering) within the cable are tested separately, they shall not convey flame, drop flaming particles that ignite cotton, or continue to burn for more than 60 s after any of five 15 s applications of a standard test flame. Compliance shall be determined in accordance with the test, FV-2/VW-1, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-192-ANCE. A specimen shall be considered to have conveyed flame if more than 25 percent of the extended portion of the indicator is burned. In parallel construction, the major diameter shall face the burner.

5.1.5.5 Coiled cords

Where sufficient straight (non-coiled) length is not available, coiled cords shall be positioned for testing by pulling the specimen taut, without any unwinding, and then clamping the specimen in place.

5.1.6 Cold bend – all types

The insulation (including any nylon or other covering), jacket (if applicable), and overall braid (if present) shall show no cracks when a specimen of the finished cord or cable is conditioned at the temperature specified in Table 42 for 4 h and, while still at the specified temperature, wound the required number of turns around the mandrel having a diameter as specified in Table 43. Compliance shall be determined in accordance with the test, Cold Bend, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-193-ANCE.

5.1.7 Weather resistance – all "W" cords and electric vehicle cables

After conditioning for 720 h in a xenon arc weatherometer as described in the test, Weather (sunlight) resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-553-ANCE, the insulation on a specimen of the individual conductor of Types CXWT[c], CXTW[u], YXTW[u] and on finished Types PXWT[c], SPT-1W[c,u], SPT-2W[c,u], HPNW[c,u], XTW[u], DPTW[c,u], DPT[c,u], and the jacket of other Type "W" cords shall:

a) Show no cracks when wound one complete turn around a mandrel having a diameter as shown in Table 43 while at a temperature of minus 30°C ±1°C for a period of 1 h. During the bending, the conditioned surface shall be opposite the surface contacting the mandrel. The specimen shall be allowed to rest 16 h to 96 h at room temperature before conducting the cold bend test.

b) Retain an average tensile strength and elongation of not less than 80 percent. Conditioned and unaged sets (five specimens each) shall be allowed to rest 16 h to 96 h at room temperature, followed by physical properties testing. Conditioned surfaces required to be die-cut shall not be buffed or skived away.

5.1.8 Heat-shock resistance

5.1.8.1 PVC and TPE insulations

The insulation shall show no cracks when specimens of finished unjacketed cords and specimens of the individual conductors from jacketed cords and Types CXWT[c], CXTW[u], YXTW[u], and TX[c] are exposed to a temperature of 121°C ±2°C for all temperature ratings of PVC and TPE rated at 60°C, or 150°C ±2°C for TPE rated in excess of 60°C, for 1 h while wound six close turns around a mandrel having a diameter as shown in Table 44. The specimen shall show no cracks when unwound from the mandrel after cooling to room temperature.

5.1.8.2 PVC- and TPE-jacketed cords and cables

The overall braid for cord with "-B" suffix (if present), jacket, and insulation on specimens of the finished cords and cables shall show no cracks after being subjected to a temperature of 121 °C ± 2 °C for all temperature ratings of PVC and TPE rated at 60°C, or 150°C ± 2°C for TPE rated higher than 60°C, for 1 h while wound around a mandrel having a diameter as shown in Table 45. The overall braid, jacket, and insulation shall show no cracks when unwound from the mandrel after cooling to room temperature.

5.1.8.3 Test method

Compliance with Clauses 5.1.8.1 and 5.1.8.2 shall be determined in accordance with the test, Heat shock resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-190-ANCE.

5.1.9 Bend test on nylon-covered conductors

A nylon covering over an individual insulated conductor (see Clause 4.1.3.4) or on a SPT-1 cord (see Clause 4.3.10.4) shall not show any cracks when wound six complete close turns around a mandrel having the same diameter as the finished conductor (the minor diameter in the case of a SPT-1 cord) after specimens have been subjected to the air-oven aging test applicable to the insulation class. Following the air-oven test, the specimen shall be allowed to cool for 16 h to 96 h prior to flexing. Wrinkles or folds in the nylon do not constitute failures.

Compliance with this test shall be in accordance with the test, Bend test on nylon covered conductors, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.1.10 Tightness of insulation test

5.1.10.1 The insulation of Types CXWT[c], CXTW[u], and YXTW[u] shall be applied tightly to reduce slipping of the conductor in the insulation when each conductor is subjected to the procedure outlined in Clause 5.1.10.2. The insulation on parallel cords other than Type TPT, shaver cords[u], NISP-1, NISP-2, NISPE-1, NISPE-2, NISPT-1, or NISPT-2 cords shall be applied tightly to reduce slipping of the insulation when subjected to the procedure outlined in Clause 5.1.10.3.

5.1.10.2 Following the method described in Clause 5.1.10.4 and with the 1.81 kg (4 lbs) weight and specimen thus suspended for a period of 30 s, slipping of the conductor, separator, or combination thereof shall not exceed 3 mm (0.11 in). Measurement shall be made at the top of the specimen at the point at which the bare conductor enters the insulation.

5.1.10.3 Following the method described in Clause 5.1.10.4 and with the 3.63 kg (8 lbs) weight and specimen thus suspended for a period of 30 s, slipping of either single conductor, separator, or combination thereof shall not exceed 3 mm (0.11 in). Measurement shall be determined from the point where the conductor is cut off even with the insulation.

5.1.10.4 Compliance with Clauses 5.1.10.2 and 5.1.10.3 shall be determined in accordance with the test, Tightness of insulation, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.1.11 Swelling and blistering – types HSJW[c,u], HSJOW, HSJOOW, SJOW, SJOOW, SOW, SOOW, EVJ, and EV

The jacket of a 10 m (33 ft) length of finished cord shall neither blister nor increase the cord diameter by more than 20 percent after the specimen of finished cord has been immersed continuously in water for two weeks at 50°C±1°C. Compliance shall be determined with the apparatus and in accordance with the test, Swelling and blistering when immersed in liquid, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.1.12 Durability of printing

Surface-printed markings shall be complete and legible after two samples have been tested in accordance with the test, Durability of ink printing, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE. One sample shall be conditioned at the rated temperature of the sample for 24 h.

5.1.13 Dry temperature rating of new materials (long-term aging test)

5.1.13.1 Scope

This test verifies the dry temperature rating of new materials and establishes short-term air-oven aging parameters and requirements.

Notes:

(1) ***The long-term aging test evaluates a material for its dry temperature rating only. Other properties are evaluated based on requirements in the applicable wire and cable standard.***

(2) ***For the product standard, after sufficient experience with a new material has been compiled, the material will be submitted for inclusion in the standard in a timely manner.***

5.1.13.2 Test method

Compliance shall be determined in accordance with the test, Dry temperature rating of new material (Long-term aging test), in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.1.14 Abrasion test for "-R" cords

5.1.14.1 Five cord specimens (with the overall braid removed, if present) shall be subjected to an abrasion motion as described in the test, Abrasion resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, and NMX-J-556-ANCE. The braid shall remain in place for Type HPD[m,u]. After 5000 cycles of abrasion, there shall be no exposure of copper conductors or shield (in the case of shielded constructions) on any of the five specimens.

5.1.14.2 The weight applied to the specimen shall exert a force of 3.3 ±0.1 N (0.74 ±0.02 lbf) or 340 ±13 gf (12.0 ±0.5 ozf).

5.1.14.3 The table shall be stopped every 800 cycles (rather than 50 cycles) and the emery cloth shall be shifted slightly to one side, so that in subsequent cycles each specimen is abraded by a fresh surface of the cloth.

5.1.15 Flexibility of braid

5.1.15.1 General

When used on HPD^{m,u}, PD^{u}, C^{u}, or cords with the "-B" suffix, the threads in the braid shall not rupture when the finished cord is tightly wrapped around itself, with adjacent turns touching, for six complete turns at room temperature.

5.1.15.2 Apparatus

The apparatus shall consist of a cylindrical mandrel in the same diameter as the finished cord.

5.1.15.3 Preparation of specimen

The test specimen shall be taken from a sample of finished wire or cable, or from the wire or cable during manufacture, without any conditioning. The length of the specimen shall be sufficient to allow winding around the mandrel for six turns.

5.1.15.4 Procedure

The specimen shall be wound around a mandrel at a uniform rate of approximately 4 s per turn at room temperature.

5.1.15.5 Examination

All surfaces of the specimen shall be examined for rupture of the threads on the braid while still wrapped around the mandrel.

5.1.16 Mandrel pinching test for "-R" cords

5.1.16.1 General

Five cord specimens (with the overall braid removed, if present) shall be subjected to a crushing/pinching force as described in Clauses 5.1.16.2 – 5.1.16.4. The braid shall remain in place for Type HPD^{m,u}. After an application of 2254 N (500 lbf), there shall be no contact on any of the five specimens between:

a) One or more circuit conductors and the flat horizontal surface;

b) One or more circuit conductor and the mandrel;

c) One or more circuit conductor and the grounding conductor; or

d) The two circuit conductors.

5.1.16.2 Apparatus

The cord shall be crushed between a flat horizontal steel surface and the corner of a rigid steel mandrel. The mandrel shall have a right-angle corner with a corner radius of 1.19 mm (0.046 in). See Figure 7 and Figure 8.

5.1.16.3 Preparation of specimen

Cord specimens shall be tested without any conditioning. The overall braid, if present, shall be removed. The braid shall remain in place for Type HPD[m,u]. The apparatus and the specimens shall be in thermal equilibrium with the surrounding air at a temperature of 25 ±5°C (77 ±9°F) throughout the test.

5.1.16.4 Procedure

5.1.16.4.1 A sample length of the cord shall be laid flat with the length of the cord at a right angle to the longitudinal axis of the mandrel.

5.1.16.4.2 The circuit conductors, steel surface, and mandrel shall be connected to low-voltage indicators (buzzers or the like) and to power supplies. The steel surface, mandrel, and any grounding conductor shall be connected together and to earth ground. The indicators shall provide a signal whenever contact is established between one or more of the circuit conductors and the steel surface, mandrel, or grounding conductor. An additional low-voltage indicator shall be connected in order to sense contact between the circuit conductors.

5.1.16.4.3 The head of a compression testing machine shall be started moving toward the bed at a rate of 5.08 ±1.27 mm/min (0.20 ±0.05 in/min). The travel shall be continued until the mandrel pushes through the insulating materials of the cable and the indicator signals or until a force of 2254 N (500 lbf) has been reached.

5.1.17 Mandrel crushing test for "-R" cords

5.1.17.1 General

Five cord specimens (with the overall braid removed, if present) shall be subjected to the crush test described in Clauses 5.1.17.2 – 5.1.17.4. The braid shall remain in place for Type HPD[m,u]. After an application of 890 N (200 lbf) for 7 h, there shall be no contact on any of the five specimens between:

a) One or more circuit conductors and the flat horizontal surface;

b) One or more circuit conductors and the mandrel;

c) One or more circuit conductors and the grounding conductor; or

d) The two circuit conductors.

5.1.17.2 Apparatus

The circuit conductors, steel surface, and mandrel shall be connected to low-voltage indicators (buzzers or the like) and to power supplies. The steel surface, mandrel, and any grounding conductor shall be connected together and to earth ground. The indicators shall provide a signal whenever contact is established between one or more of the circuit conductors and the steel surface, mandrel, or grounding conductor. An additional low-voltage indicator shall be connected in order to sense contact between the circuit conductors.

5.1.17.3 Preparation of specimen

Cord specimens shall be tested without any conditioning. The overall braid, if present, shall be removed. The braid shall remain in place for Type HPD[m,u]. The apparatus and the specimens shall be in thermal equilibrium with the surrounding air at a temperature of 25.0 ±5.0°C (77.0 ±9.0°F) throughout the test.

5.1.17.4 Procedure

5.1.17.4.1 A sample length of the cord shall be laid flat with the length of the cord at right angles to the longitudinal axis of the mandrel.

5.1.17.4.2 The cord shall be squeezed between a flat horizontal steel surface and the corner of a rigid steel mandrel for a period of 7 h. The mandrel shall have a right-angle corner with a corner radius of 1.19 mm (0.046 in). See Figure 7 and Figure 8.

5.1.18 Flexing test for "-R" cords

5.1.18.1 General

Six samples of a power-supply cord shall be subjected to the test described in Clauses 5.1.18.2 – 5.1.18.4. Upon completion of the test, the following conditions shall not occur on any of the specimens:

a) Development of a short circuit;

b) Breakage of more than 10 percent of the strands of any circuit or grounding conductor;

c) Broken strands piercing the insulation and becoming accessible;

d) Cracking or degradation of the cord insulation; or

e) Exposure of the shield on shielded constructions.

5.1.18.2 Apparatus

Each supply cord sample shall be mounted through a slot in the L-bracket of the test fixture shown in Figure 9. The L-bracket shall measure 38.1 mm (1.5 in) deep and 38.1 mm (1.5 in) high and shall be provided with a slot having dimensions as shown in Figure 9. The cord shall exit vertically through the top surface of the bracket base and shall be routed across a curved surface for attachment (see Figure 9).

5.1.18.3 Preparation of sample

The cord shall be passed through a horizontal bushing having a smoothly rounded 25.4 mm (1 in) diameter opening, located 305 mm (1 ft) below the centre of rotation. The free end of the cord shall be attached to a 110 g (0.25 lbs) unsupported weight.

5.1.18.4 Procedure

5.1.18.4.1 During the test, the conductors shall be loaded to the maximum rated current based on conductor size and cord type. A voltage of 300 V shall be applied between the conductors. Current shall not be passed through the grounding conductor, which shall be connected to ground. The circuit shall be protected by a time-delay fuse as indicated in Table 60. One or more series current relays shall be provided to shut down the machine if a conductor opens.

5.1.18.4.2 The six assemblies shall be flexed at a rate of approximately 20 cycles per minute for 3100 cycles. One cycle consists of a 90-degree rotation of the test assembly in one direction, a 180-degree rotation in the opposite direction and then a return to the starting point. A short circuit between conductors of the cord is determined when, at any time during the test, the time-delay fuse opens.

5.1.19 Tinsel flexing test

5.1.19.1 Six specimens shall be cut from a sample length of the finished wire or cord and shall be tested without any conditioning. The apparatus and the specimens shall be in thermal equilibrium with the surrounding air at a temperature of 23.0 ±8.0°C (73.4 ±14.4°F) throughout the test.

5.1.19.2 Each specimen shall be bent into the form of a flat-bottomed square-cornered U with the legs of the U straight and of equal length. The bottom of the U in each case shall be taped to the underside of a movable round horizontal rod (A in Figure 10) with the axis of the conductor or conductors parallel to the longitudinal axis of the movable rod and the legs of the U extending vertically downward between a pair of fixed round rods (B in Figure 10) that are 12.7 mm (0.50 in) in diameter. A weight exerting 0.210 ±0.003 N (0.75 ±0.01 ozf) shall be attached to the free end of each leg. The conductors of the specimens shall be connected in series. The longitudinal axes of the two fixed rods shall be in a horizontal plane and shall be parallel to one another and to the longitudinal axis of the movable rod to which the specimens are taped. The distance between the two rods shall be adjusted to result in the specimens hanging midway between the rods, with a space from specimen to rod of near 1 mm (1/32 in) on each side. A current of 1.5 A shall be passed through the conductor(s).

5.1.19.3 The movable rod shall be started in the pivoted motion (simple harmonic motion) depicted by the dashed lines in Figure 10 at the rate of 12 cycles per minute, each cycle consisting of one complete back-and-forth motion through an angle of 180° centring about the points of flexure. The motion shall be stopped after 6000 cycles and each specimen shall be cut open and examined for broken strands at the points of flexure against the two fixed rods. The wire or cord does not comply where more than half of the strands are broken in any leg of any specimen (12 legs in all) in the 6000 cycles of flexing.

5.1.20 Abrasion test for Types XTW^{u}, CXTW^{u}, CXTW-IS^{u}, and YXTW^{u}

5.1.20.1 General

The insulation on the 0.325 mm^2 (22 AWG) size of Types XTW^{u} and CXTW^{u} wire and of the straightened individual conductors from finished Type CXTW^{u} cord shall not wear through to expose the conductor or conductors in 400 or fewer cycles on any of the specimens. Type CXTW-IS^{u} cord shall not wear through to expose the strength member or the conductor in 400 or fewer cycles on any of the specimens. The insulation on an YXTW wire shall not wear through to expose the conductor in 600 or fewer cycles on any specimens.

5.1.20.2 Apparatus

The apparatus and the specimens shall be in thermal equilibrium with the surrounding air at a temperature of 23.0 ±8.0°C (73.4 ±14.4°F) throughout the test.

The equipment shall consist of:

a) A reciprocating table capable of a simple harmonic motion at a rate of 28 cycles per minute;

b) A weight that exerts 1.1 ±0.1 N (4.0 ±0.5 ozf), and

c) Grade 1/2 (medium) emery cloth.

5.1.20.3 Specimen preparation

Six straight specimens 1000 mm (40 in) long shall be cut from a sample length of the finished wire or straightened conductor from the finished cord and shall be tested without any conditioning.

5.1.20.4 Procedure

One end of each specimen shall be attached to a horizontal reciprocating table while the table is at one end of its travel. The other end of each specimen shall be attached to a weight that exerts 1.1 ±0.1 N (4.0 ±0.5 ozf). Each specimen shall be laid over a quarter cylinder to whose outer surface an unused sheet of grade 1/2 (medium) emery cloth is attached. The radius of the surface of the emery cloth shall be 90 mm (3.5 in). The longitudinal axis of the cylinder shall be horizontal and perpendicular to each of the vertical planes that contain the specimens as they move on and are abraded by the emery cloth.

The table shall be started in its horizontal reciprocating motion (simple harmonic motion) at the rate of 28 cycles per minute, each cycle consisting of one complete back-and-forth motion with a stroke of 160 mm (6.3 in). The table shall be stopped every 50 cycles and the emery cloth shall be shifted slightly to one side so that in subsequent cycles each specimen is abraded by a fresh surface of the cloth.

5.1.20.5 Examination

Following the completion of the 400 cycles of abrasion, the weights shall be removed from the specimens. The cord shall be examined for exposure of conductors. The CXTW-IS^{u} cord shall be examined for exposure of conductors or strength members.

5.1.21 Flexing test for Types XTW^{u}, CXTW^{u}, XTW-IS^{u}, and YXTW^{u}

5.1.21.1 General

No more than half the strands in any conductor in the 0.325 mm^2 (22 AWG) size of Types XTW^{u}, CXTW^{u}, and CXTW-IS^{u} cord and wire shall be broken by 6000 cycles of the flexing. In addition, for type CXTW-IS^{u}, as a result of the 6000 cycles of flexing, the strength member shall not be damaged and the strength member within the insulation of the Type CXTW-IS^{u} shall not damage the insulation. Damage of the insulation includes, but is not limited to exposure of the conductor or splitting of the insulation. No more than half the strands in any conductor of a Type YXTW^{u} wire shall be broken by 9000 cycles of the flexing. No more than half the strands in any conductor of a Type YXTW^{u} wire shall be broken by 9000 cycles of the flexing.

5.1.21.2 Apparatus

The apparatus and the specimens shall be in thermal equilibrium with the surrounding air at a temperature of 23.0 ±8.0°C (73.4 ±14.4°F) throughout the test.

The apparatus shall consist of:

a) Weight exerting 0.210 ±0.003 N (0.75 ±0.01 ozf);

b) Fixed round rods 12.7 mm (0.50 in) in diameter, and

c) A movable rod capable of a simple harmonic motion at a rate of 12 cycles per minute in a semi-circular path.

5.1.21.3 Specimen preparation

Six specimens shall be cut from a sample length of the finished wire or cord and shall be tested without any conditioning.

5.1.21.4 Procedure

Each specimen shall be bent into the form of a flat-bottomed square-cornered U with the legs of the U straight and of equal length. The bottom of the U in each case shall be taped to the underside of a movable round horizontal rod (A in Figure 10) with the axis of the conductor or conductors parallel to the longitudinal axis of the movable rod and the legs of the U extending vertically downward between a pair of fixed round rods (B in Figure 10) that are 12.7 mm (0.50 in) in diameter. A weight exerting 0.210 ±0.003 N (0.75 ±0.01 ozf) shall be attached to the free end of each leg. The conductors of the specimens shall be connected in series. The longitudinal axes of the two fixed rods shall be in a horizontal plane and shall be parallel to one another and to the longitudinal axis of the movable rod to which the specimens are taped. The distance between the two rods shall be adjusted to result in the specimens hanging midway between the rods, with a space from specimen to rod of near 1 mm (0.04 in) on each side. A current of 1.5 A shall be passed through the conductor(s).

The movable rod shall be started in the pivoted motion (simple harmonic motion) depicted by the dashed lines in Figure 10 at the rate of 12 cycles per minute, each cycle consisting of one complete back-and-forth motion through an angle of 180° centring about the points of flexure. The motion shall be stopped after 6000 cycles.

5.1.21.5 Examination

Following the completion of the appropriate number of cycles of flexing, the weights shall be removed from the specimens. The wire or cord shall be cut open at the points of flexure against the two fixed rods and the number of broken strands counted in each conductor. In addition, for Type CXTW-IS^{u}, the strength member at the point of flexure shall be inspected for any damage. The insulation of the Type CXTW-IS^{u} shall also be inspected for damage.

5.1.22 Low-temperature impact test (Types EV, EVE, and EVT)

5.1.22.1 Electric vehicle cables containing at least one conductor 5.26 mm^2 (10 AWG) or larger shall not exhibit cracks or ruptures visible to normal or corrected-to-normal vision in the overall jacket component insulation or component shield coverings on at least 8 out of 10 specimens of finished cable when tested in accordance with the test, Cold impact, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE after conditioning for 4 h at minus 25°C or at the lower temperature rating marked on the cable.

5.1.23 Crush resistance test (Types EV, EVJ, EVJT, EVE, EVT, and EVJE^{m})

5.1.23.1 Finished cable shall be subjected to the test, Crush resistance, in accordance with CAN/CSA-C22.2 No. 2556 or UL 2556; Method 2 (drill rod and plate).

5.1.23.2 Results and calculations – each finished cable shall comply with the minimum average crush force as indicated below:

a) For cable with at least one conductor up to and including 3.31 mm^2 (12 AWG) conductors – 4.45 kN (1,000 lbs).

b) For cable using larger than 3.31 mm^2 (12 AWG) and up through 33.6 mm^2 (2 AWG) conductors – 11.1 kN (2,500 lbs).

c) For cable using larger than 33.6 mm^2 (2 AWG) conductors – 15.6 kN (3,500 lbs).

5.1.24 Breaking strength test for CXTW-S^{u} and CXTW-IS^{u}

5.1.24.1 Three specimens of a single conductor CXTW-S^{u} or CXTW-IS^{u} containing fibrous (non-metallic) strands complying with Clause 4.1.1.7.2.7 or 4.3.16.2 respectively, shall be subjected to the test described in Clauses 5.1.24.2 and 5.1.24.3. The average and minimum force to cause breakage shall be 249 and 204 N (56 and 46 lbf) respectively.

5.1.24.2 Each specimen shall be cut from a finished cord. The length of the specimen shall be sufficient to allow a spacing of 25 mm (1 in) between the grips of a tensile testing machine. The machine shall be a power-driven machine provided with a device that indicates the maximum load reached. The machine shall be capable of separating the grips at speeds of 500 ±25 mm/min (20 ±1 in/min), and also at 50 ±5 mm/min (2 ±0.2 in/min). The applied load as indicated shall be accurate to 2 percent or less of the value read.

5.1.24.3 The specimen shall be clamped in the tensile machine. The tension shall be increased by separating the clamps at a rate of 53 N/min (12 lbf/min) until the cord breaks. The force at which the cord breaks shall be recorded.

5.1.25 Breaking strength test for CXTW-X^{u}, LXT-X^{u} and LXTW-X^{u}

5.1.25.1 Three specimens of a single conductor CXTW-X^{u}, LXT-X^{u} and LXTW-X^{u} containing fibrous (non-metallic) strands complying with Clause 4.1.1.7.2.7 shall be subjected to the test described in Clauses 5.1.24.2 and 5.1.24.3. The average and minimum force to cause breakage shall be 125 and 102 N (28 and 23 lbf) respectively.

5.2 Electrical properties

5.2.1 Spark test

The following shall withstand a spark test using an AC test voltage as shown in Table 46:

a) All individual insulated conductors and the jacket of finished duplex or coaxial cable intended for incorporation in completed Type E, EO, ETT, and ETP cables;

b) All finished individual insulated conductors (including the grounding conductor and any nylon or other covering) intended for incorporation in completed cords and cables; and

c) All finished integral constructions, before the application of any overall outer braid.

For the spark test on three conductor integral constructions, the grounding conductor need not be connected to either of the other conductors, to the ground, or to any part of the electrical test circuit while the cord is being run through the electrode. DC spark testing is optional (see Note * to Table 46). Compliance shall be determined in accordance with the test, Spark, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-473-ANCE. As an alternative to the spark test, the finished cord or cable shall comply with the dielectric strength test in Clause 5.2.2.

5.2.2 Dielectric strength for all finished types

The finished individual insulated conductors (including any nylon or other covering) of finished flexible cords and cables shall be capable of withstanding for 1 min, without breakdown, the application of an alternating (rms) voltage as indicated in Table 47 between each insulated conductor and between the insulated conductors and any other conductive components and ground, on a specimen at least 15 m (50 ft) in length. All "W" Type cords and electric vehicle cables shall be conditioned in water for a period of at

least 6 h prior to testing. All indoor cords shall be conditioned in air at room temperature for a period of at least 6 h prior to testing.

For all "W" Type cords and electric vehicle cables, the dielectric strength test shall be performed in accordance with the test, Dielectric Voltage-Withstand Method 1, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-293-ANCE.

For all indoor type cords, the dielectric strength test shall be performed in accordance with the test, Dielectric Voltage-Withstand Method 1, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-293-ANCE except without immersion in water.

5.2.3 Insulation resistance

5.2.3.1 Insulation resistance for all "W" Type cords and electric vehicle cables at 15°C

Before assembly into an outdoor jacketed cord, finished individual insulated conductors (circuit and grounding and including any nylon or other covering) shall be capable of exhibiting an insulation resistance of not less than shown in Table 48 or Table 49, when a specimen of at least 15 m (50 ft) is tested in water at 15°C immediately following the dielectric strength test described in Clause 5.2.2.

For all other "W" type cords, the cable shall be tested as a complete assembly.

If tested at temperatures different than 15°C, the values shall be corrected to 15°C.

5.2.3.2 Insulation resistance for all indoor cords at room temperature

The insulation resistance between each insulated conductor and between the insulated conductors and any other conductive components and ground shall be not less than 0.76 GΩ·m (2.5 MΩ·1000 ft) at 15°C when a specimen of the finished cord at least 15 m (50 ft) in length is tested in air after conditioning for at least 6 h and immediately following the dielectric strength test described in Clause 5.2.2.

5.2.3.3 Test method

Compliance with all insulation resistance tests shall be determined in accordance with the test, Insulation resistance, and Annex E (Determination of temperature correction factor) in CAN/CSA-C22.2 No. 2556, UL 2556, or Annex B in NMX-J-294-ANCE.

5.2.4 Permittivity and stability factor

5.2.4.1 Permittivity – "W" Type cords and electric vehicle cables

5.2.4.1.1 When tested in accordance with the test, Capacitance and relative permittivity, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-040-ANCE, the permittivity of the insulation (with nylon and any other covering removed), shall be as follows:

a) After 14 d of immersion, the capacitance shall not be more than 10 percent greater than the capacitance measured after the first day.

b) After 14 d of immersion, the capacitance shall not be more than 3percent greater than the capacitance measured after 7 d.

5.2.4.1.2 Tests shall be made using three 5 m (16 ft) specimens. Specimens shall be

a) Tested without any polyester tape or similarly non-absorptive separator; and

b) Selected before assembly into finished cord.

The middle 3 m (10 ft) of each specimen shall be immersed continuously in tap water in a temperature of 50°C ±1°C for thermoset insulation or 60°C ±1°C for thermoplastic insulations for 14 d. The 1 m (3 ft) end portions of each specimen shall be kept dry above the water as leakage insulation. A cover for the tank shall be placed directly above the surface of the water. The water level shall be kept constant.

5.2.4.2 Stability factor – "W" Type cords and electric vehicle cables

When tested in accordance with test, Stability factor, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-205-ANCE, the insulation (with nylon and any other covering removed), on 3 specimens of 5 m (16 ft) each shall meet one of the following requirements:

a) The stability factor (the numerical difference between the percentage power factors measured with current at average stresses of 3150 V/mm and 1575 V/mm (80 V/mil and 40 V/mil)) after the fourteenth day of immersion shall not be greater than 1.0; or

b) The difference between the stability factors measured after the first and fourteenth days shall not be greater than 0.5.

5.2.5 Standard arcing test for types HPN and HPNW^{c,u}

Types HPN and HPNW^{c,u} cord shall not arc when a specimen of finished cord is connected at one end to a 120 V 48 – 62 Hz ac source of supply through a 15 A fuse or circuit breaker and subjected to a standard test flame 125 mm (5 in) from the other end of the specimen for 2 min. Compliance shall be determined in accordance with the test, Standard arcing test, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.2.6 Flex arcing test for types HPN and HPNW^{c,u}

A minimum of three specimens of Types HPN and HPNW^{c,u} cord shall be tested, and each specimen shall be caused to make and break the circuit for 20 cycles. Perforation of the insulation due to arcing, as evidenced by burning or charring of the bleached cheesecloth, in 20 cycles or less indicates a failure. The cheesecloth shall run 29.4 to 31.2 m^2/kg (12 to 20 yd^2/lb) and have a count of approximately 24-28 by 28-32. Compliance shall be determined in accordance with the test, Flex arcing test, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE. The flexing rate shall be 15 to 20 cycles per min. A make and break shall be considered one cycle.

5.2.7 Continuity of conductors

The conductors in every length of finished flexible cord and cable shall be continuous. Compliance shall be determined in accordance with the test, Continuity, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.2.8 Copper corrosion

5.2.8.1 General

5.2.8.1.1 A bare (uncoated) copper insulated conductor shall show no evidence of corrosion when tested in accordance with the test, Copper corrosion, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE, and when performed at the temperature and for the duration under air oven test described in Table 9.

5.2.8.1.2 An uncoated copper shield in direct contact with an insulation, jacket, and/or tape shall show no evidence of corrosion when tested as noted in Clauses 5.2.8.2 – 5.2.8.5, using the forced-circulation air oven described in the Apparatus under Physical properties (ultimate elongation and tensile strength) in CAN/CSA C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE. The temperature and duration of the air oven test shall be as follows:

a) Cords and Cable rated 60°C, tested at 7 days at 100°C;

b) Cords and Cable rated 75°C, tested at 10 days at 100°C;

c) Cords and Cable rated 90°C, tested at 7 days at 121°C; and

d) Cords and Cable rated 105°C, tested at 7 days at 136°C.

5.2.8.2 Preparation of specimens

5.2.8.2.1 A complete cable employing the uncoated copper shield in contact with the insulation, jacket and/or tape shall be cut to lengths not less than 300 mm (12 in) that allow for at least one specimen to be placed in the oven vertically.

5.2.8.3 Procedure

5.2.8.3.1 One specimen shall be conditioned at room temperature. The second specimen shall be conditioned in the oven at the specified temperature. Oven temperatures shall be recorded throughout the period of conditioning. The specimen shall then be removed from the oven and allowed to cool to room temperature.

5.2.8.3.2 The cable shall be dissected and the shield on both specimens examined with normal vision.

5.2.8.4 Results and calculations

Any evidence of corrosion of the copper shield (normal oxidation or discoloration not caused by the insulation, jacket and/or any tape shall be disregarded) shall be noted.

5.2.8.5 Report

The report shall include, as a minimum, the following:

a) Test temperature;

b) Test duration; and

c) Evidence of corrosion on conditioned and unconditioned specimens.

5.2.9 Flexing of shielded cords (see Clause 4.1.5.6)

The cord shall not be acceptable if any circuit conductor opens in fewer than 15 000 cycles in any of the six specimens when tested in accordance with the test, Flexing of shielded cables, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE. The weight, pulleys, and current used in the test shall be as indicated in Table 61.

5.2.10 Jacket resistance

A nonintegral jacket of thermoplastic or thermosetting material shall exhibit 100 MΩ or more resistance when a specimen of the finished cord (with the overall braid removed, if present) is tested in accordance with the test, Jacket resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.2.11 AC leakage current test for low-leakage cords

The AC leakage current test shall be performed in accordance with the test, AC leakage current test through insulation, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-556-ANCE.

5.3 Tests for hoistway cables

5.3.1 Flame test

Finished parallel constructions, finished twisted constructions, and the individual insulated conductors of twisted constructions shall be tested in accordance with Clause 5.1.5.1.

5.3.2 Heat-shock resistance test

5.3.2.1 General

The insulation shall show no cracks, either externally or internally, when a finished parallel construction or one of the insulated conductors of the twisted construction is wound six adjacent turns around a mandrel with a diameter equal to the minor axis of the cable in the case of the parallel construction, or equal to the diameter of the specimen of the insulated conductor in the case of the twisted construction. The sample shall then be exposed for 1 h to a temperature of 121°C ±2°C. After exposure and while still on the mandrel, specimens shall withstand the dielectric strength test of Clause 5.3.4. The insulation shall show no cracks when the specimen is unwound from the mandrel following the dielectric strength test.

5.3.2.2 Twisted conductor construction of hoistway cables with an overall jacket rated 60°C

The jacket and insulation on twisted conductor hoistway cables rated 60°C shall show no cracks when specimens of the finished cable are exposed to a temperature of 121°C ±2°C, for a period of 1 h while wound around a mandrel with a diameter as specified in Table 50.

5.3.2.3 Twisted conductor construction of hoistway cables with an overall jacket rated at 90°C

The jacket and insulation on twisted conductor construction of hoistway cables rated at 90°C shall show no cracks when specimens of the finished cable are exposed to a temperature of 121°C ±2°C for a period of 1 h while wound around a mandrel with a diameter as specified in Table 51.

5.3.2.4 Test method

The tests referenced in Clauses 5.3.2.1, 5.3.2.2, and 5.3.2.3 shall be performed in accordance with the test, Heat-shock resistance, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-190-ANCE.

5.3.3 Cold bend test

5.3.3.1 The tests in Clauses 5.3.3.2 and 5.3.3.3 shall be performed in accordance with the test, Cold bend, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-193-ANCE.

5.3.3.2 The insulation shall show no cracks when a specimen of finished parallel construction, or of one of the insulated conductors of a twisted construction, is wound six close turns around a mandrel with a diameter as specified in Table 52, immediately following exposure at minus 20°C ±1°C for 4 h.

5.3.3.3 The jacket and insulation on the individual conductors of twisted conductor construction hoistway cables with an overall jacket shall show no cracks when a specimen of the finished cable is conditioned at minus 20°C ±1°C for 4 h and, while still at this temperature, is wound the required number of turns around a mandrel with a diameter as specified in Table 53.

5.3.4 Dielectric strength

The insulation on a specimen of finished parallel construction and on a specimen of insulated conductor of a twisted construction subjected to the heat-shock resistance test of Clause 5.3.2 shall withstand for 1 min, without breakdown, an alternating (rms) potential of 1500 V between the conductor and the tap water in which the specimen has been immersed, except for its ends, for a period of 1 h, when tested in accordance with the test, Dielectric voltage withstand, in CAN/CSA-C22.2 No. 2556, UL 2556, or NMX-J-293-ANCE.

6 Marking

6.1 General

In addition to the required markings for finished cords and cables covered in Clauses 6.2 and 6.3, additional marks necessary for specific national applications shall be permitted. See Annex C for marking translations.

6.2 Product marking

6.2.1 General

6.2.1.1 Unless otherwise specified, the marking shall consist of surface printing, indent marking, embossing, or a marker tape under the jacket. For types suffixed with a "-B" and with the marking provided on a marker tape, the marker tape shall be located directly under the overall braid. No ampacity or other current designation (except as noted in Clauses 6.2.4(f), 6.6.3, and 6.7.3) or the word "outdoor" shall appear on the flexible cord, electric vehicle cable, elevator cable, or hoistway cable.

6.2.1.2 In the absence of smooth areas on the surface of a jacketed cord, the markings shall be acceptable if durably and legibly printed at intervals no longer than 600 mm (24 in) on a marker tape in the cord.

6.2.2 Intervals

If the marking is not continuous, it shall appear at a maximum interval of 600 mm (24 in).

6.2.3 Required markings on all cords

See Clause 6.5.1 for hoistway cables, Clause 6.6.3 for additional markings for recreational vehicles, and Clause 6.7.3 for additional markings for mobile homes and recreational vehicles. All other flexible cords or cables covered by this standard shall have the following markings:

a) A durable distinctive marking throughout its entire length by which the organization responsible for the product is readily identified (examples of acceptable means are name, trademark, or an assigned combination of coloured marker threads);

b) The type designation;

c) The maximum temperature rating;

d) The number of conductors and sizes: in Canada and Mexico, the size marking shall be mm^2 (AWG) or AWG (mm^2); in the United States, the size marking shall be AWG with optional mm^2; and

Note: ***"mm^2" may be replaced by "mm2". The use of either a comma or a period signifies a decimal. For example:***

1) ***3 X 3.31 mm^2 (12 AWG) or 3 X 3,31 mm2 (12 AWG);***

2) ***3/C 3.31 mm^2 (12 AWG) or 3/C 3.31 mm2 (12 AWG);***

3) ***3 X 12 AWG or 3/C 12 AWG (US only); and***

4) ***3 X 12 AWG (3.31 mm^2) or 3/C 12 AWG (3.31 mm2).***

e) voltage rating.

6.2.4 Additional surface markings on finished product

The following markings, where applicable, shall be surface-marked on the finished product:

a) The low temperature rating for all "W" type cords –50°C, – 60°C, or –70°C in accordance with Clause 5.1.6 and electric vehicle cables when rated –40°C, –50°C, – 60°C, or –70°C in accordance with Clauses 5.1.6 and 5.1.22;

b) The word "shielded" for cords that are provided with a shield;

c) The words "metal support member" for cords that are provided with a metal core in accordance with Clause 4.1.11.3;

d) The suffix "-B" shall be placed directly after the cord designation for those cords described in Clauses 4.2.8 and 4.3.8. If the cord type already contains the suffix "-R", the "-B" shall follow the "-R".

In Mexico this marking does not apply.

e) "Green conductor for Grounding Only" or "Green conductor with yellow stripes for Grounding Only" for all integral parallel types;

f) For low-leakage cords conforming to Clause 4.3.14, the wording "Max leakage/3m at __V: __ µA to green and µA thru jacket" or "Max. leakage/10 ft. at __V: __ µA to green and µA thru jacket", with applicable values from Table 24 inserted;

g) The suffix "-R" shall be placed directly after the cord designation for those cords which comply with the requirements in Clauses 5.1.14, and 5.1.16 – 5.1.18;

In Canada and Mexico, this marking does not apply.

h) "w/thrd" or the words "with thread" placed directly after conductor size on cords that contain conductors with fibrous (non-metallic) thread(s) in accordance with Clause 4.1.1.7.2.6.

In Mexico, this marking does not apply.

i) The suffix "-S" shall be placed directly after the cord designation for single conductor, decorative cords that contain a conductor with a fibrous (nonmeltallic) thread in accordance with Clause 4.1.1.7.2.7 and comply with the breaking strength requirements in Clause 5.1.24.

In Canada and Mexico, this marking does not apply;

j) The suffix "-X" shall be placed directly after the cord designation for single conductor, decorative cords that contain a conductor with a fibrous (nonmeltallic) thread in accordance with Clause 4.1.1.7.2.7 and comply with the breaking strength requirements in Clause 5.1.25.

In Canada and Mexico, this marking does not apply;

k) The suffix "-IS" shall be placed directly after the cord designation for single conductor, 0.325 mm^2 (22 AWG) CXTW that contain a fibrous (nonmetallic) thread(s) embedded in the insulation in accordance with Clause 4.3.16.1 and complying with the requirements in Clauses 4.3.16.2 – 4.3.16.6.

In Canada and Mexico, this marking does not apply.

6.2.5 Flame test marking

In Canada and the United States, the following applies. Products complying with the applicable flame test shall be marked with at least one of the following:

a) The legend "FT1", to indicate compliance with the flame test requirements of Clause 5.1.5.1;

b) The legend "FT4", to indicate compliance with the flame test requirements of Clause 5.1.5.2;

c) The legend "FT2", to indicate compliance with the flame test requirements of Clause 5.1.5.3; or

d) The legend "VW-1", to indicate compliance with the flame test requirements of Clause 5.1.5.4.

Note: Products marked with "FT4" need not be marked "FT1" or "FT2". Products marked with "VW-1" need not be marked "FT1" or "FT2". Products marked with "FT1" need not be marked "FT2".

In Mexico, the following applies. Flame test markings shall be optional. Use of the following flame markings shall be permitted: "FH" or "FT2"; "FV-2"; "FV-1" or "FT1"; and "FT4".

6.2.6 Oil-resistance marking

6.2.6.1 Oil-resistance jacket

Types EO, ETT, ETP, EV, EVJ, EVJT, EVE, EVT, EVJE, HPN, HPNW[c,u], and cords marked with the letter "O" included in the type designation (e.g., SJO, STOW, and SEO) shall have a jacket that complies with the specified oil test in Table 12.

The use of the letter "O" is not permitted in the type designation of types ETT, ETP, EV, EVJ, EVJT, EVE, EVT, EVJE, HPN, and HPNW[c,u].

6.2.6.2 Oil-resistant insulation and jacket

A cord having both an oil-resistant insulation and jacket complying with the specified oil test in Table 9 and Table 12 shall have the letter suffix "OO" included in the type designation (e.g., SJOOW, STOO, and SEOO).

6.3 Optional markings

The following additional information may be printed on the finished product if desired by the manufacturer:

a) The wording "water resistant" or "water resistant 60°C" for "W" type cords and electric vehicle cables;

b) A part, specification, or catalog designation or other required information, provided that it is in no way confusing or misleading;

c) Compound identification expressed in a singular form when the insulation and jacket are of the same material (e.g., "CPE") or expressed in a dual form listing the insulation first and the jacket last when not using common materials; and

d) The marking "–40°C" for "W" type cords.

6.4 Package marking

Notes:

(1) ***See Annex C for information on translation of caution markings.***

(2) ***For hoistway package marking, see Clause 6.5.2.***

6.4.1 A tag on which the information specified in Items (a) to (e) is indicated plainly shall be attached to every shipping length of finished wire or cable. However, if the wire or cable is wound on a reel or coiled in a carton, the tag shall be glued, tied, stapled, or otherwise acceptably attached to the reel or carton instead of to the wire or cable, or the tag shall be eliminated and the information printed or stenciled directly onto the reel or carton. The required information is as follows:

a) Manufacturer's name, assigned file number, registered trade name, or trademark;

b) Date of manufacture by month and year (a code is acceptable);

c) Type designation: "clock" in the case of clock cord[U]; "shaver cord" in the case of shaver cord[U];

d) Voltage rating; and

e) The number of conductors and size(s): the marking shall be in accordance with clause 6.2.3(d).

6.4.2 Products complying with Note (2) of Table 13 shall be tagged, marked, or otherwise labelled "Small or large diameter cord in process" and "Not for general use".

6.4.3 A cable that contains one or more optical fibres shall be tagged, marked, or otherwise labelled with the following statement or another statement to the same effect:

"Optical-fibre portion(s) of cable are for installation (optical and electrical functions associated) as described in applicable parts of the *Canadian Electrical Code, Part I*, the *National Electrical Code* (NEC), and *La Norma de Instalaciones Electricas* (NOM 001-SEDE), with levels of energy transmitted not exceeding those of Class I laser radiation (21 CFR Part 1040)."

For a cable that contains one or more optical-fibre members with any individual optical fibre member or group of such members with a metal or other electrically conductive part, the following wording or other wording to the same effect shall be provided:

"Optical-fibre portion(s) of cable contain non-current-carrying metal or other electrically conductive parts".

6.4.4 In Canada and the United States, the following applies. The tag, reel, or carton shall show the following information:

a) "For use in general use extension cord sets only" for Types SPE-2 and SPT-2 cords having conductors composed of 0.166 mm to 0.260 mm (0.0066 in to 0.010 in) wires;

b) "Not for sale to the general public:"

TX[c]

PXT[c]

shaver cord[u]

clock cord[u]

TPT

TST

single conductor component of CXWT[c]

cords with "-B" suffix

NISPT-1, NISP-1, NISPE-1, SPT-1, SP-1, SPE-1, and SPT-2 having 0.519 mm^2 (20 AWG) conductors.

HPNW[c,u]; and

c) Single conductor component CXWT[c] to be used only for the manufacture of two conductor CXWT[c].

In Mexico, these requirements do not apply.

6.5 Hoistway cables

6.5.1 Product marking

The manufacturer's name, "Hoistway Cable", voltage rating, flame rating, and temperature rating shall be durably and legibly printed in ink on the surface of at least one of the conductors of a parallel construction or a twisted construction without a jacket (in a multi-layer cable, the marking shall appear on one of the wires in the outer layer), or on the surface of the jacket of twisted constructions with a jacket. Each conductor shall have its size durably and legibly printed in ink, except in the case of the parallel construction, where marking one conductor with the number and size of conductors indicated in Clause 6.2.3(d), shall be permitted. The number and size of the conductors shall also be marked on the surface of jacketed cables. The distance between the required markings shall not exceed 600 mm (24 in).

6.5.2 Marking on coils, spools, and reels

A tag on which the information specified in Items (a) – (f) is indicated plainly shall be attached to every shipping length of finished wire or cable. However, if the wire or cable is wound on a reel or coiled in a carton, the tag shall be glued, tied, stapled, or otherwise acceptably attached to the reel or carton instead of to the wire or cable, or the tag shall be eliminated and the information printed or stenciled directly onto the reel or carton. The required information is as follows:

a) Manufacturer's name;

b) Date of manufacture by month and year;

c) Type designation "Hoistway Cable";

d) Voltage rating;

e) Conductor size(s) and number of conductors;

f) Temperature rating;

g) For a cable that contains one or more optical fibres, the following statement or another statement to the same effect: "Optical-fibre portion(s) of cable are for installation (optical and electrical functions associated) as described in applicable parts of the *Canadian Electrical Code, Part I*, *National Electrical Code* (NEC), and the *La Norma de Instalaciones Electricas* (NOM-001-SEDE), with levels of energy transmitted not exceeding those of Class I laser radiation (21 CFR Part 1040)"; and

h) For a cable that contains one or more optical-fibre members with any individual optical-fibre member or group of such members with a metal or other electrically conductive part, the following wording or other wording to the same effect: "Optical-fibre portion(s) of cable contain non-current-carrying metal or other electrically conductive parts".

6.6 Recreational vehicle cord

6.6.1 General

In Mexico and the United States, Clauses 6.6.2 and 6.6.3 apply. In Canada, the requirements of the CAN/CSA-Z240RV Series apply.

6.6.2 Construction

A flexible cord to be employed in a cord set or power-supply cord that is intended for use in recreational vehicles shall be a Type SOOW, SOW, STOOW, STOW, STW, SEOOW, SEOW, or SEW cord. Such a cord shall have two insulated 2.08 mm^2 (14 AWG), 3.31 mm^2 (12 AWG), or 5.26 mm^2 (10 AWG) circuit conductors and one insulated grounding conductor of the same size as the circuit conductors. For use in the marking specified for the cord surface in Clause 6.6.3, a current rating of 15 A shall apply to cord with 2.08 mm^2 (14 AWG) circuit conductors; a current rating of 20 A shall apply to cord with 3.31 mm^2 (12 AWG) circuit conductors; and a current rating of 30 A shall apply to cord with 5.26 mm^2 (10 AWG) circuit conductors.

6.6.3 Product marking

Type SEW, SOW, SEOW, SEOOW, SOOW, STW, STOOW, or STOW cord that complies with the requirements for recreational-vehicle use in Clause 6.6.2 shall be durably surface marked in accordance with Clause 6.2 and with the following wording using the applicable current rating from Clause 6.6.2: "For recreational-vehicle use: _____amperes".

6.7 Mobile home and recreational vehicle cord

6.7.1 General

In Mexico and the United States, Clauses 6.7.2 and 6.7.3 apply. In Canada, the requirements of the CAN/CSA-Z240RV Series apply.

6.7.2 Construction

A flexible cord to be employed in a power-supply cord intended for use in mobile homes and recreational vehicles shall be a Type SOOW, SOW, STOOW, STOW, STW, SEOOW, SEOW, or SEW cord. Such a cord shall either have three insulated 8.37 mm^2 (8 AWG) circuit conductors and one insulated grounding conductor of the same size as the circuit conductors or have three insulated 13.3 mm^2 (6 AWG) circuit conductors and one insulated 13.3 or 8.37 mm^2 (6 or 8 AWG) grounding conductor. For use in the marking specified for the cord surface in Clause 6.7.3, a current rating of 40 A shall apply to this cord with 8.37

mm^2 (8 AWG) circuit conductors, and a current rating of 50 A shall apply to this cord with 13.3 mm^2 (6 AWG) circuit conductors.

6.7.3 Product marking

A Type SEW, SOW, SEOW, SEOOW, SOOW, STW, STOOW, or STOW cord that complies with the requirements in Clause 6.7.2 shall be durably surface marked in accordance with Clause 6.2 and with one of the following wordings, using the applicable current rating from Clause 6.7.2: "For mobile-home use:___ amperes" or "For mobile-home or recreational-vehicle use: _____ amperes".

Tables

Table 1
Cross-sectional area of stranded conductors and diameter of solid conductors

(See Clause 4.1.1.3.1.)

Conductor size		Maximum diameter of solid conductors		Nominal circular mil area	Maximum cross-sectional area of stranded conductors	
mm^2	(AWG/kcmil)	mm	(in)	(circular mils)	mm^2	(circular mils)
0.162	(25)	0.46	(0.018)	(320)	0.168	(326)
0.205	(24)	0.52	(0.020)	(404)	0.209	(412)
0.259	(23)	0.58	(0.023)	(511)	0.264	(521)
0.325	(22)	0.65	(0.026)	(640)	0.330	(653)
0.519	(20)	0.82	(0.033)	(1 020)	0.525	(1 040)
0.824	(18)	1.03	(0.040)	(1 620)	0.836	(1 652)
1.04	(17)	1.16	(0.046)	(2 050)	1.06	(2 091)
1.31	(16)	1.30	(0.051)	(2 580)	1.34	(2 632)
1.65	(15)	1.47	(0.058)	(3 260)	1.68	(3 325)
2.08	(14)	1.64	(0.065)	(4 110)	2.12	(4 192)
2.63	(13)	1.85	(0.073)	(5 180)	2.68	(5 283)
3.31	(12)	2.07	(0.082)	(6 530)	3.37	(6 661)
4.17	(11)	–	–	(8 230)	4.25	(8 395)
5.26	(10)	–	–	(10 380)	5.36	(10 588)
6.63	(9)	–	–	(13 090)	6.76	(13 352)
8.37	(8)	–	–	(16 510)	8.53	(16 840)
10.6	(7)	–	–	(20 820)	10.75	(21 236)
13.3	(6)	–	–	(26 240)	13.57	(26 765)
16.8	(5)	–	–	(33 090)	17.09	(33 752)
21.2	(4)	–	–	(41 740)	21.55	(42 575)
26.7	(3)	–	–	(52 620)	27.18	(53 672)
33.6	(2)	–	–	(66 360)	34.27	(67 687)
42.4	(1)	–	–	(83 690)	43.27	(85 398)
53.3	(1/0)	–	–	(105 600)	54.59	(107 755)
67.4	(2/0)	–	–	(133 100)	68.78	(135 816)
85.0	(3/0)	–	–	(167 800)	86.73	(171 224)
107.2	(4/0)	–	–	(211 600)	109.39	(215 918)
127	(250)	–	–	(250)	129.59	(255 102)
152	(300)	–	–	(300)	155.10	(306 122)
177	(350)	–	–	(350)	180.61	(357 143)
203	(400)	–	–	(400)	207.14	(408 163)
228	(450)	–	–	(450)	232.65	(459 184)
253	(500)	–	–	(500)	258.16	(510 204)

Table 2
Stranding

(See Clauses 4.1.1.7.1 and 4.4.1.2.)

Cord or cable type	Conductor size**	Diameter of individual wires			
		Minimum		Maximum	
		mm	(in)	mm	(in)
SPT-0[m]	0.325 mm^2 (22 AWG)	0.125	(0.0049)	0.260	(0.010)
CXTW[u], CXWT[c], XTW[u]	0.325 mm^2 (22 AWG)	0.079	(0.0031)	0.165	(0.0065)
YXTW[u]	0.519 mm^2 (20 AWG) and 0.824 mm^2 (18 AWG)	0.125	(0.0049)	0.260	(0.010)
SP-1*, SP-2, SPT-1*, SPT-2, SPT-1W[c,u], SPT-2W[c,u], SVT, SVTO, SVTOO, SV, SVO, SVOO, HPN, HPNW[c,u], HSJ, HSJW[c,u], HSJO, HSJOW, HSJOO, HSJOOW, HPD[m,u], SPE-1*, SPE-2, SVE, SVEO, SVEOO[u], NISP-1, NISP-2, NISPT-1, NISPT-2, NISPE-1, NISPE-2, DPTW[c,u], DPT[c,u], clock[u]	All sizes	0.125*	(0.0049)*	0.165†	(0.0065)†
				0.260**	(0.010**)
SJ, SJT, SJTO, SJTOO, SJO, SJOO, SJOW, SJOOW, S, SO, SOO, SOW, SOOW, SJTW, SJTOW, SJTOOW, ST, STO, STOO, STW, STOW, STOOW, SP-3, SPT-3, PXWT[c], CXWT[c], SJE, SJEW, SJEO, SJEOW, SJEOO, SJEOOW, SE, SEW, SEO, SEOW, SEOO, SEOOW, SPE-3, EVJ, EVJE, EVJT, EV, EVE, EVT	2.63 mm^2 (13 AWG) and smaller	0.125	(0.0049)	0.260	(0.010)
	3.31 – 33.6 mm^2 (12 – 2 AWG)	0.125	(0.0049)	0.410‡	(0.016)‡
E, EO, ETT, ETP	All sizes	0.125	(0.0049)	0.260	(0.010)
CXTW[u], XTW[u]	0.519 mm^2 (0.824 mm^2 (20 – 18 AWG)	0.125	(0.0049)	0.260	(0.010)
PXT[c], TX[c]	0.325 mm^2 (22 AWG) and 0.519 mm^2 (20 AWG)	0.125	(0.0049)	0.260	(0.010)
EV, EVE, EVT	42.4 – 67.4 mm^2 (1 – 2/0 AWG)	Minimum 133 strands, stranded size not specified			
	85.0 mm^2 – 253 mm^2 (3/0 AWG – 500 kcmil)	Minimum 259 strands, stranded size not specified			
All other types (except hoistway cable[&])	4.17 mm^2 (11 AWG) and smaller	0.125	(0.0049)	0.410	(0.016)
	5.26 mm^2 (10 AWG) and larger[§]	0.125	(0.0049)	0.821	(0.032)

** For SPT-1, SP-1, and SPE-1[u] types, a composition of wires having sizes not smaller than that of 0.079 mm (0.0031 in) for 0.519 mm^2 (20 AWG) conductors shall be permitted.*

*** Stranded sizes only permitted in Mexico.*

† In Canada and the United States, the following applies. For 2 X 1.31 mm^2 (16 AWG), 3 X 1.31 mm^2 (16 AWG), 2 X 0.824 mm^2 (18 AWG), and 3 X 0.824 mm^2 (18 AWG) Type SPT-2 and SPE-2[u] flexible cords, a diameter of the individual wires in the conductors of 0.166 mm to 0.260 mm (0.0066 in to 0.010 in) shall be permitted when such cords are for use in extension cord sets other than those with cord take-up reels. In Mexico, this is not applicable.

Table 2 Continued on Next Page

Table 2 Continued

Cord or cable type	Conductor size**	Diameter of individual wires			
		Minimum		Maximum	
		mm	(in)	mm	(in)

‡ *Sizes 0.259 mm² and 0.162 mm² (23 AWG and 25 AWG) strands, respectively, shall be permitted for 33.6 mm² and 21.2 mm² (2 AWG and 4 AWG) size extra-hard-usage cords.*

§ *All conductors of Type DRT[c] cable in sizes 5.26 mm² (10 AWG) and larger shall be composed of not fewer than 49 strands, except for sizes 3.31 mm – 5.26 mm² (12 – 10 AWG) grounding conductors; for these sizes the grounding conductors may employ a minimum of 7 strands.*

[&]See 4.7.3 for hoistway cable conductors.

Table 3
Lay of conductor strands

(See Clauses 4.1.1.7.2.1, 4.1.1.7.2.2, 4.1.1.7.2.4, and 4.4.1.2.)

Conductor size, mm² (AWG)	Maximum length of lay		
	Bunch-stranded (lay of wires), mm (in)	Rope-stranded (lay of rope), mm (in)	Bunch- or rope-strand for HPN and HPNW[c,u] (lay of wires), mm (in)
0.162 (25)	32 (1.25)*	–	–
0.205 (24)	32 (1.25)*	–	–
0.259 (23)	32 (1.25)*	–	–
0.325 (22)	32 (1.25)*	–	–
0.519 (20)	32 (1.25)	44 (1.75)	–
0.824 (18)	32 (1.25)	44 (1.75)	25 (1.00)
1.04 (17)	32 (1.25)	44 (1.75)	25 (1.00)
1.31 (16)	38 (1.50)	57 (2.25)	32 (1.25)
1.65 (15)	38 (1.50)	57 (2.25)	32 (1.25)
2.08 (14)	44 (1.75)	64 (2.50)	41 (1.60)
2.63 (13)	44 (1.75)	64 (250)	41 (1.06)
3.31 (12)	51 (2.00)	76 (3.00)	51 (2.00)
4.17 (11)	51 (2.00)	76 (3.00)	–
5.26 (10)	64 (2.50)	76 (3.00)	–
6.63 (9)	64 (2.50)	76 (3.00)	–
8.37 (8)	70 (2.75)	76 (3.00)	–
10.6 (7)	–	89 (3.50)	–
13.3 (6)	–	89 (3.50)	–
16.8 (5)	–	114 (450)	–
21.2 (4)	–	114 (4.50)	–
26.7 (3)	–	140 (5.50)	–
33.6 (2)	–	140 (5.50)	–
42.4 (1) or larger	–	16 times finished stranded conductor diameter	–

* *For Types CXTW[u] and XTW[u], and signal conductors in electric vehicle cables. See Clause 4.1.1.7.2.2.*

Table 4
Maximum direct current resistance of stranded and solid conductors at 20°C, Ω/km

(See Clause 4.1.1.3.1.)

Conductor size		Bare copper		Coated copper	
mm^2	(AWG/kcmil)	Solid	Stranded*	Solid	Stranded*
0.162	(25)	108	112.7	112.8	118.7
0.205	(24)	85.9	89.2	89.3	94.0
0.259	(23)	68.0	70.6	70.7	74.4
0.325	(22)	54.0	56.8	56.2	59.7
0.519	(20)	34.0	35.7	35.3	37.6
0.824	(18)	21.4	22.4	22.2	23.6
1.04	(17)	16.9	17.8	17.6	18.7
1.31	(16)	13.4	14.1	14.0	14.9
1.65	(15)	10.6	11.2	11.1	11.5
2.08	(14)	8.45	8.88	8.79	9.34
2.63	(13)	6.69	7.02	6.95	7.39
3.31	(12)	5.31	5.58	5.53	5.88
4.17	(11)	–	4.43	–	4.79
5.26	(10)	–	3.51	–	3.70
6.63	(9)	–	2.78	–	3.03
8.37	(8)	–	2.23	–	2.35
10.6	(7)	–	1.77	–	1.86
13.3	(6)	–	1.40	–	1.48
16.8	(5)	–	1.11	–	1.17
21.2	(4)	–	0.882	–	0.928
26.7	(3)	–	0.700	–	0.736
33.6	(2)	–	0.555	–	0.584
42.4	(1)	–	0.440	–	0.463
53.5	(1/0)	–	0.351	–	0.368
67.4	(2/0)	–	0.279	–	0.293
85.0	(3/0)	–	0.220	–	0.231
107.2	(4/0)	–	0.174	–	0.183
127	(250)	–	0.148	–	0.156
152	(300)	–	0.125	–	0.131
177	(350)	–	0.105	–	0.111
203	(400)	–	0.092	–	0.097
228	(450)	–	0.082	–	0.086
253	(500)	–	0.075	–	0.079

** Applicable for all types of stranding.*

Table 5
Maximum direct current resistance of stranded and solid conductors at 25°C, Ω/km

(See Clause 4.1.1.3.1.)

Conductor size		Bare copper		Coated copper	
mm^2	(AWG/kcmil)	Solid	Stranded*	Solid	Stranded*
0.162	(25)	109.7	114.5	114.6	120.6
0.205	(24)	87.3	91.8	91.1	97.0
0.259	(23)	69.1	71.7	71.8	75.9
0.325	(22)	55.1	57.9	57.3	60.9
0.519	(20)	34.7	36.4	36.0	38.4
0.824	(18)	21.8	22.8	22.6	24.1
1.04	(17)	17.2	18.2	18.0	19.1
1.31	(16)	13.7	14.4	14.3	15.2
1.65	(15)	10.8	11.4	11.3	11.8
2.08	(14)	8.62	9.06	8.97	9.53
2.63	(13)	7.17	7.38	7.31	7.77
3.31	(12)	5.42	5.69	5.64	6.00
4.17	(11)	–	4.64	–	4.89
5.26	(10)	–	3.58	–	3.77
6.63	(9)	–	2.93	–	3.09
8.37	(8)	–	2.27	–	2.40
10.6	(7)	–	1.80	–	1.90
13.3	(6)	–	1.43	–	1.51
16.8	(5)	–	1.13	–	1.19
21.2	(4)	–	0.900	–	0.947
26.7	(3)	–	0.714	–	0.746
33.6	(2)	–	0.566	–	0.596
42.4	(1)	–	0.449	–	0.473
53.5	(1/0)	–	0.358	–	0.376
67.4	(2/0)	–	0.285	–	0.300
85.0	(3/0)	–	0.224	–	0.236
107.2	(4/0)	–	0.178	–	0.187
127	(250)	–	0.151	–	0.159
152	(300)	–	0.128	–	0.134
177	(350)	–	0.107	–	0.113
203	(400)	–	0.094	–	0.099
228	(450)	–	0.083	–	0.088
253	(500)	–	0.077	–	0.080

** Applicable for all types of stranding.*

Table 6
Maximum direct current resistance of stranded and solid conductors at 20°C, Ω/1000 ft

(See Clause 4.1.1.3.1.)

Conductor size		Bare copper		Coated copper	
mm^2	(AWG/kcmil)	Solid	Stranded*	Solid	Stranded*
0.162	(25)	32.9	34.3	34.4	36.2
0.205	(24)	26.2	27.4	27.1	28.9
0.259	(23)	20.7	21.5	21.6	22.6
0.325	(22)	16.5	17.3	17.1	18.2
0.519	(20)	10.4	10.9	10.8	11.5
0.824	(18)	6.52	6.83	6.77	7.20
1.04	(17)	5.15	5.43	5.37	5.70
1.31	(16)	4.09	4.30	4.27	4.54
1.65	(15)	3.25	3.41	3.41	3.55
2.08	(14)	2.58	2.71	2.68	2.85
2.63	(13)	2.10	2.21	2.19	2.32
3.31	(12)	1.62	1.70	1.69	1.79
4.17	(11)	–	1.39	–	1.46
5.26	(10)	–	1.07	–	1.13
6.63	(9)	–	0.880	–	0.923
8.37	(8)	–	0.690	–	0.716
10.6	(7)	–	0.547	–	0.568
13.3	(6)	–	0.427	–	0.451
16.8	(5)	–	0.339	–	0.358
21.2	(4)	–	0.269	–	0.283
26.7	(3)	–	0.213	–	0.224
33.6	(2)	–	0.169	–	0.178
42.4	(1)	–	0.134	–	0.141
53.5	(1/0)	–	0.107	–	0.113
67.4	(2/0)	–	0.085	–	0.090
85.0	(3/0)	–	0.067	–	0.071
107.2	(4/0)	–	0.053	–	0.056
127	(250)	–	0.045	–	0.048
152	(300)	–	0.038	–	0.040
177	(350)	–	0.033	–	0.035
203	(400)	–	0.029	–	0.031
228	(450)	–	0.026	–	0.027
253	(500)	–	0.023	–	0.025

** Applicable for all types of stranding.*

Table 7
Maximum direct current resistance of stranded and solid conductors at 25°C, Ω/1000 ft

(See Clause 4.1.1.3.1.)

Conductor size		Bare copper		Coated copper	
mm^2	(AWG/kcmil)	Solid	Stranded*	Solid	Stranded*
0.162	(25)	33.5	34.8	34.9	37.5
0.205	(24)	26.7	28.1	27.8	29.3
0.259	(23)	21.1	21.9	22.0	23.0
0.325	(22)	16.8	17.7	17.5	18.6
0.519	(20)	10.6	11.1	11.0	11.7
0.824	(18)	6.65	6.95	6.89	7.35
1.04	(17)	5.24	5.55	5.49	5.82
1.31	(16)	4.18	4.39	4.36	4.63
1.65	(15)	3.30	3.47	3.45	3.62
2.08	(14)	2.63	2.76	2.73	2.91
2.63	(13)	2.14	2.25	2.23	2.37
3.31	(12)	1.65	1.73	1.72	1.83
4.17	(11)	–	1.41	–	1.49
5.26	(10)	–	1.09	–	1.15
6.63	(9)	–	0.865	–	0.941
8.37	(8)	–	0.692	–	0.732
10.6	(7)	–	0.548	–	0.580
13.3	(6)	–	0.436	–	0.460
16.8	(5)	–	0.345	–	0.364
21.2	(4)	–	0.274	–	0.289
26.7	(3)	–	0.217	–	0.229
33.6	(2)	–	0.173	–	0.182
42.4	(1)	–	0.137	–	0.144
53.5	(1/0)	–	0.109	–	0.115
67.4	(2/0)	–	0.087	–	0.092
85.0	(3/0)	–	0.069	–	0.073
107.2	(4/0)	–	0.055	–	0.058
127	(250)	–	0.046	–	0.049
152	(300)	–	0.039	–	0.041
177	(350)	–	0.033	–	0.035
203	(400)	–	0.029	–	0.031
228	(450)	–	0.026	–	0.027
253	(500)	–	0.023	–	0.025

** Applicable for all types of stranding.*

Table 8
Insulations

(See Clause 4.1.2.)

Class no.	Material type	Material description	Temperature rating, maximum, °C		
			Dry	Wet	Oil
1	Thermoset	NR or IR, SBR, EP or a blend thereof	60	60	60
2	Thermoset	NR or IR, SBR, EP or a blend thereof	75	60	60
3	Thermoset	NR or IR, SBR, IIR, EP, or a blend thereof	90	60	60
4	Thermoplastic	PVC	60	60	60
5	Thermoplastic	PVC	75	60	60
6	Thermoplastic	PVC	90	60	60
7	Thermoplastic	PVC	105	60	60
8	Thermoplastic	PE	60	–	–
9	Thermoplastic	PE	75	–	–
10	Thermoset	XL	90	–	–
11	Thermoset	XL	105	–	–
12	Thermoset	CR, CSM, CPE, NBR/PVC	90	60	60
13	Thermoset	CR, CSM, CPE, NBR/PVC	60	60	60
14	Thermoplastic	TPE	60	60	60
15	Thermoplastic	TPE	90	60	60
16	Thermoplastic	TPE	105	60	60
17	Thermoplastic	PVC	90	–	–
18	Thermoset	CPE, CSM	105	60	60
19	Thermoset	EP	105	60	60
20	Thermoplastic	FEP	105	–	–

Legend:

NR or IR = *natural rubber or polyisoprene rubber*
SBR = *styrene-butadiene rubber*
EP = *ethylene propylene rubber*
IIR = *isobutylene-isoprene rubber*
CPE = *chlorinated polyethylene*
CR = *polychloroprene*
CSM = *chloro-sulphonyl-polyethylene*
TPE = *thermoplastic elastomer*
PVC = *polyvinyl chloride or copolymer of vinyl chloride and vinyl acetate*
PE = *polyethylene*
XL = *cross-linked polyethylene*
FEP = *fluorinated ethylene propylene*
NBR = *acrylonitrile butadiene rubber*

Table 9
Physical properties – insulation (before aging)

(See Clauses 5.1.1, 5.2.8, and 6.2.6.2.)

Class no.	Temperature rating, maximum, °C			Material type	Before aging	
	Dry	Wet	Oil		Minimum elongation percent	Tensile strength, MPa (lbf/in^2)
1	60	60	60	Thermoset	200	3.4 (500)
2	75	60	60	Thermoset	200	3.4 (500)
3	90	60	60	Thermoset	200	3.4 (500)
4	60	60	60	Thermoplastic	100	10.3 (1500)
5	75	60	60	Thermoplastic	100	10.3 (1500)
6	90	60	60	Thermoplastic	100	10.3 (1500)
7	105	60	60	Thermoplastic	100	10.3 (1500)
8	60	–	–	Thermoplastic	350	9.65 (1400)
9	75	–	–	Thermoplastic	350	9.65 (1400)
10	90	–	–	Thermoset	150	10.3 (1500)
11	105	–	–	Thermoset	150	10.3 (1500)
12	90	60	60	Thermoset	200	8.3 (1200)
13	60	60	60	Thermoset	200	8.3 (1200)
14	60	60	60	Thermoplastic	200	5.5 (800)
15	90	60	60	Thermoplastic	200	5.5 (800)
16	105	60	60	Thermoplastic	200	5.5 (800)
17	90	–	–	Thermoplastic	100	10.3 (1500)
18	105	60	60	Thermoset	200	8.3 (1200)
19	105	60	60	Thermoset	200	3.4 (500)
20	105	–	–	Thermoplastic	200	17.4 (2500)

(Continued)

Table 9
Physical properties – insulation (after aging)

Class no.	After aging							
	Air oven test				Oil immersion test*			
			Minimum percentage of unaged value		IRM 902 Oil		Minimum percentage of unaged value	
	Oven temp., °C ±2	Time, d	Elongation, percent	Tensile strength, percent	Oil temp., °C ±2	Time, h	Elongation, percent	Tensile strength, percent
1	70	7	65	60	N/A	–	–	–
2	100	10	50	50	N/A	–	–	–
3	110	10	50	50	N/A	–	–	–
4	100	7	65	85	N/A	–	–	–
5	100	10	65	85	N/A	–	–	–
6	121	7	65	85	N/A	–	–	–
7	136	7	65	85	N/A	–	–	–
8	70	2	75	N/A	N/A	–	–	–
9	100	2	75	N/A	N/A	–	–	–
10	121	7	45	70	N/A	–	–	–
11	136	7	45	70	N/A	–	–	–
12	110	10	50	50	121	18†	60†	60†
13	70	7	65	75	121	18†	60†	60†
14	100	7	75	75	N/A	–	–	–
15	121	7	75	75	N/A	–	–	–
16	136	7	75	75	N/A	–	–	–
17	121	14	65	85	N/A	–	–	–
18	136	7	50	50	121	18†	60†	60†
19	136	7	50	50	N/A	–	–	–
20	232	7	75	75	N/A	–	–	–

** The incorporation of an oil-resistant insulation in a finished jacketed cord shall be permitted provided that the insulation is subjected to the specified oil test in Table 12 for the jacket being used. Cords having both insulations and jacket materials meeting the oil resistance test shall be marked in accordance with Clause 6.2.6.2.*

† Required for HPN and HPNW^{c,u} only.

Note: *Interchanging insulation materials within the table shall be permitted (see Clause 4.1.2.1).*

Table 10
Lay of conductors – Service cords and electric vehicle cables

(See Clauses 4.1.4.1.1, 4.4.4.2, and 4.5.4.2.1.)

Type	Size of circuit conductor, mm² (AWG)**	Maximum lay of twist, mm (in)				
		Two-conductor*	Three-conductor*	Four-conductor	Five-conductor	Six-conductor
SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, SVEOO	0.824 (18)	35 (1.38)	44 (1.75)	–	–	–
	1.04 (17)	38 (1.50)	51 (2.00)	–	–	–
	1.31 (16)	38 (1.50)	51 (2.00)	–	–	–
TST	0.100 (27)	35 (1.38)	—	—	—	—
SJ, SJO, SJOO, SJOW, SJOOW, S, SO, SOO, SOW, SOOW, SJT, SJTO, SJTOO, SJTW, SJTOW, SJTOOW, ST, STO, STOO, STW, STOW, STOOW, SJE, SJEO, SJEOO, SJEW, SJEOW, SJEOOW, SE, SEO, SEOO, SEW, SEOW, SEOOW, C[u], PD[u], HPD[u]**, HSJ**, HSJW[c,u]**, HSJO**, HSJOW**, HSJOO**, HSJOOW**	0.824 (18)	51 (2.00)	57 (2.25)	64 (2.50)	76 (3.00)	89 (3.50)
	1.04 (17)	51 (2.00)	57 (2.25)	64 (2.50)	76 (3.00)	89 (3.50)
	1.31 (16)	57 (2.25)	64 (2.50)	70 (2.75)	89 (3.50)	108 (4.25)
	1.65 (15)	57 (2.25)	64 (2.50)	70 (2.75)	89 (3.50)	108 (4.25)
	2.08 (14)	64 (2.50)	83 (3.25)	95 (3.75)	121 (4.75)	140 (5.50)
	2.63 (13)	64 (2.50)	83 (3.25)	95 (3.75)	121 (4.75)	140 (5.50)
	3.31 (12)	76 (3.00)	89 (3.50)	108 (4.25)	140 (5.50)	165 (6.50)
	4.17 (11)	76 (3.00)	89 (3.50)	108 (4.25)	140 (5.50)	165 (6.50)
	5.26 (10)	89 (3.50)	108 (4.25)	121 (4.75)	152 (6.00)	178 (7.00)
S, SO, SOO, SOW, SOOW, ST, STO, STOO, STW, STOW, STOOW, SE, SEO, SEOO, SEW, SEOW, SEOOW	6.63 (9)	89 (3.50)	108 (4.25)	121 (4.75)	15 times the overall diameter of the conductor assembly under the jacket	15 times the overall diameter of the conductor assembly under the jacket
	8.37 (8)	114 (4.50)	127 (5.00)	152 (6.00)	–	–
	10.6 (7)	114 (4.50)	127 (500)	152 (6.00)	–	–
	13.3 (6)	127 (5.00)	152 (6.00)	178 (7.00)	–	–
	16.8 (5)	127 (5.00)	152 (6.00)	178 (7.00)		
	21.2 (4)	152 (6.00)	178 (7.00)	216 (9.50)	–	–
	26.7 (3)	152 (6.00)	178 (7.00)	216 (9.50)		
	33.6 (2)	178 (7.00)	203 (8.00)	254 (10.00)	–	–
DRT[c], SRD[m,u], SRDT[m,u], SRDE[m,u]	5.26 (10)		108 (4.25)	120 (4.72)	–	–

Table 10 Continued on Next Page

Table 10 Continued

Type	Size of circuit conductor, mm^2 (AWG)**	Maximum lay of twist, mm (in)				
		Two-conductor*	Three-conductor*	Four-conductor	Five-conductor	Six-conductor
	6.63 (9)		108 (4.25)	121 (4.75)		
	8.37 (8)		127 (5.00)	150 (5.91)	–	–
	13.3 (6)		152 (6.00)	180 (7.09)	–	–
	21.2 (4)		178 (7.00)	220 (8.66)	–	–
EVJ, EVJE, EVJT, EV, EVE, EVT	All	15 times the overall diameter of the conductor assembly under the jacket	15 times the overall diameter of the conductor assembly under the jacket	15 times the overall diameter of the conductor assembly under the jacket	15 times the overall diameter of the conductor assembly under the jacket	15 times the overall diameter of the conductor assembly under the jacket

** In Mexico, the following applies. As an alternative to the values of the table, untwisted conductors shall be permitted for two- or three-conductor constructions.*

*** Two, three, and four conductors only.*

Table 11
Jackets

(See Clause 4.1.6.)

Class no.	Material type	Material description	Temperature ratings, maximum, °C	
			Dry	Oil
1.1	Thermoset	NR or IR, SBR, EP or a blend thereof	60	–
1.2	Thermoset	CR, CSM, EP, NBR/PVC, CPE	60	60
1.3	Thermoset	CR, CSM, EP, NBR/PVC, CPE	75	60
1.4	Thermoset	CR, CSM, EP, NBR/PVC, CPE	90	60
1.5	Thermoplastic	PVC	60	60
1.6	Thermoplastic	PVC	75	60
1.7	Thermoplastic	PVC	90	60
1.8	Thermoplastic	PVC	105	60
1.9	Thermoplastic	TPE	60	60
1.10	Thermoplastic	TPE	90	60
1.11	Thermoplastic	TPE	105	60
1.12	Thermoset	CPE, CSM, EP	105	60

Legend:

NR or IR = *natural rubber or polyisoprene rubber*

SBR = *styrene-butadiene rubber*

EP = *ethylene propylene rubber*

CPE = *chlorinated polyethylene*

CR = *polychloroprene*

CSM = *chloro-sulphonyl-polyethylene*

TPE = *thermoplastic elastomer*

PVC = *polyvinyl chloride or copolymer of vinyl chloride and vinyl acetate*

NBR = *acrylonitrile butadiene rubber*

Note: *Due to possible incompatibility, TPE material of styrenic type is in some cases not suitable for use in cords where direct contact with PVC can occur. A separator is one acceptable means of avoiding direct contact. Other combinations of materials that could be incompatible, if any, are as yet undetected.*

Table 12
Physical properties – Jackets (before aging)

(See Clauses 5.1.2, 6.2.6.1, and 6.2.6.2.)

Class no.	Temperature rating, maximum, °C		Material type	Before aging	
	Dry	Oil		Minimum Elongation percent	Tensile strength, MPa (lbf/in^2)
1.1	60	–	Thermoset	200	8.3 (1200)
1.2	60	60	Thermoset	200†	8.3 (1200)
1.3	75	60	Thermoset	200	8.3 (1200)
1.4	90	60	Thermoset	200	8.3 (1200)
1.5	60	60	Thermoplastic	100	10.3 (1500)
1.6	75	60	Thermoplastic	100	10.3 (1500)
1.7	90	60	Thermoplastic	100	10.3 (1500)
1.8	105	60	Thermoplastic	100	10.3 (1500)
1.9	60	60	Thermoplastic	200	8.3 (1200)
1.10	90	60	Thermoplastic	200	8.3 (1200)
1.11	105	60	Thermoplastic	200	8.3 (1200)
1.12	105	60	Thermoset	200	8.3 (1200)

(Continued)

Table 12
Physical properties – jackets (after aging)

Class no.	Air oven test				Oil immersion test*			
			Minimum percentage of unaged value		IRM 902 Oil		Minimum percentage of unaged value	
	Oven temp., °C ±2	Time, d	Elongation, percent	Tensile strength, percent	Oil temp., °C ±2	Time, h	Elongation, percent	Tensile strength, percent
1.1	70	7	70	75	NA	–	–	–
1.2	70	7	70	75	121	18	60	60
1.3	100	10	50	50	121	18	60	60
1.4	110	10	50	50	121	18	60	60
1.5	100	7	45	85	60	168	75	75
1.6	100	10	45	70	60	168	75	75
1.7	121	7	45	85	60	168	75	75
1.8	136	7	45	85	60	168	75	75
1.9	100	7	75	75	60	168	75	75
1.10	121	7	75	75	60	168	75	75
1.11	136	7	75	75	60	168	75	75
1.12	136	7	65	70	121	18	60	60

** Oil tests are required only on Type EO, ETT, and ETP on Types EV, EVJ, EVJT, EVE, EVT, EVJE, or on products with an "O" and "OO" in the type designation (see Clause 6.2.6).*

† The elongation requirements for Class 1.2 jackets on coiled Types SVO, SJO, and SO cords shall be 150 percent.

Note: *Interchanging jacket materials within the table shall be permitted (see Clause 4.1.6.2).*

Table 13
Overall diameter of round service and heater cords

(See Clauses 4.1.5.5, 4.1.7.1, 4.1.8.2, 4.3.14.2, 4.8.8, and 6.4.2.)

Type of cord	Range of overall diameters*, mm (in)				
	Size of conductors, mm^2 (AWG)	Two-conductor	Three-conductor	Four-conductor	Five-conductor
HSJ, HSJW[c,u], HSJO, HSJOO, HSJOW, HSJOOW	0.824 (18)	7.24 – 8.38	7.62 – 8.76	8.38 – 9.65	–
		(0.285 – 0.330)	(0.300 – 0.345)	(0.330 – 0.380)	–
	1.04 (17)	7.50 – 8.64	7.94 – 9.14	9.02 – 9.98	–
		(0.295 – 0.340)	(0.313 – 0.360)	(0.355 – 0.393)	–
	1.31 (16)	7.75 – 8.89	8.26 – 9.52	9.02 – 10.3	–
		(0.305 – 0.350)	(0.325 – 0.375)	(0.355 – 0.405)	–
	1.65 (15)	9.68 – 10.91	10.3 – 11.5	11.3 – 12.65	–
		(0.381 – 0.429)	(0.406 – 0.452)	(0.445 – 0.498)	–
	2.08 (14)	10.03 – 11.3	10.67 – 11.94	11.7 – 13.1	–
		(0.395 – 0.445)	(0.420 – 0.470)	(0.460 – 0.515)	–
	3.31 (12)	11.1 – 12.3	11.7 – 13.1	13.0 – 14.5	–
		(0.435 – 0.485)	(0.460 – 0.515)	(0.510 – 0.570)	–
SV, SVO, SVOO, SVT, SVTO, SVTOO, SVE, SVEO, SVEOO	0.824 (18)	5.59 – 6.48	5.84 – 6.73	–	–
		(0.220 – 0.255)	(0.230 – 0.265)	–	–
	1.04 (17)	5.97 – 6.86	6.35 – 7.24	–	–
		(0.235 – 0.270)	(0.250 – 0.285)	–	–
	1.31 (16)	6.22 – 7.11	6.60 – 7.49	–	–
		(0.245 – 0.280)	(0.260 – 0.295)	–	–
SJ, SJO, SJOO, SJT, SJTO, SJTOO, SJOW, SJOOW, SJTW, SJTOW, SJTOOW SJE, SJEO, SJEOO, SJEW, SJEOW, SJEOOW	0.824 (18)	7.11 – 8.00	7.62 – 8.51	8.26 – 9.27	–
		(0.280 – 0.315)	(0.300 – 0.335)	(0.325 – 0.365)	–
	1.04 (17)	7.24 – 8.26	7.75 – 8.76	8.64 – 9.65	–
		(0.285 – 0.325)	(0.305 – 0.345)	(0.340 – 0.380)	–
	1.31 (16)	7.75 – 8.64	8.26 – 9.14	8.89 – 10.0	–
		(0.305 – 0.340)	(0.325 – 0.360)	(0.350 – 0.395)	–

Table 13 Continued on Next Page

Table 13 Continued

Type of cord	Range of overall diameters*, mm (in)				
	Size of conductors, mm^2 (AWG)	Two-conductor	Three-conductor	Four-conductor	Five-conductor
	1.65 (15)	8.00 – 8.89	8.51 – 9.52	9.40 – 10.54	–
		(0.315 – 0.350)	(0.335 – 0.375)	(0.370 0.415	–
	2.08 (14)	8.51 – 9.53	9.14 – 10.0	9.91 – 11.0	–
		(0.335 – 0.375)	(0.360 – 0.395)	(0.390 – 0.435)	–
	2.63 (13)	8.76 – 9.91	9.40 – 10.5	10.3 – 11.4	–
		(0.345 – 0.3910)	(0.370 – 0.415)	(0.405 – 0.450)	–
	3.31 (12)	10.3 – 11.6	10.8 – 12.1	11.8 – 13.2	–
		(0.405 – 0.455)	(0.425 – 0.475)	(0.465 – 0.520)	–
	4.17 (11)	10.6 – 11.9	11.3 – 12.6	12.3 – 13.6	–
		(0.420 – 0.470)	(0.445 – 0.495)	(0.485 – 0.535)	–
	5.26 (10)	13.7 – 15.4	14.4 – 16.1	15.9 – 17.8	–
		(0.540 – 0.605)	(0.565 – 0.635)	(0.625 – 0.700)	–
S, SO, SOO, SOW, SOOW, ST, STO, STOO, STW, STOW, STOOW, SE, SEO, SEOO, SEW, SEOW, SEOOW	0.824 (18)	8.64 – 9.78	9.14 – 10.2	9.78 – 10.9	11.7 – 13.0
		(0.340 – 0.385)	(0.360 – 0.400)	(0.385 – 0.430)	(0.460 – 0.510)
	1.04 (17)	8.89 – 9.91	9.40 – 10.54	10.16 – 11.30	11.81 – 13.21
		(0.350 – 0.390)	(0.370 – 0.415)	(0.400 – 0.445)	(0.465 – 0.520)
	1.31 (16)	9.27 – 10.4	9.78 – 10.9	10.4 – 11.7	12.5 – 14.0
		(0.365 – 0.410)	(0.385 – 0.430)	(0.410 – 0.460)	(0.490 – 0.550)
	1.65 – (15)	12.07 – 13.46	12.70 – 14.22	13.72 – 15.94	15.62 – 17.52
		(0.475 – 0.530)	(0.500 – 0.560)	(0.540 – 0.610)	(0.615 – 0.690)
	2.08 (14)	12.6 – 14.0	13.2 – 14.6	14.2 – 15.7	16.0 – 17.9
		(0.495 – 0.550)	(0.520 – 0.575)	(0.560 – 0.620)	(0.630 – 0.705)
	2.63 (13)	12.84 – 14.2	13.6 – 15.0	14.6 – 16.0	16.7 – 18.2
		(0.505 – 0.560)	(0.535 – 0.590)	(0.575 – 0.630)	(0.660 – 0.715)
	3.31 (12)	14.4 – 15.9	15.0 – 16.6	16.3 – 18.0	17.8 – 19.6
		(0.565 – 0.625)	(0.590 – 0.655)	(0.640 – 0.710)	(0.700 – 0.770)

Table 13 Continued on Next Page

Table 13 Continued

Type of cord	Range of overall diameters*, mm (in)				
	Size of conductors, mm^2 (AWG)	Two-conductor	Three-conductor	Four-conductor	Five-conductor
	4.17 (11)	14.7– 16.6	15.5 – 17.1	16.7 – 18.4	18.3 – 20.1
		(0.580 – 0.645)	(0.610 – 0.675)	(0.660 – 0.725)	(0.720 – 0.790)
	5.26 (10)	15.6 – 17.4	16.5 – 18.3	17.8 – 19.7	19.3 – 21.3
		(0.615 – 0.685)	(0.650 – 0.720)	(0.700 – 0.775)	(0.760 – 0.840)
	6.63 (9)	16.1 – 18.3	17.0 – 19.2	18.4 – 20.6	20.2 – 22.4
		(0.635 – 0.720)	(0.670 – 0.755)	(0.725 – 0.810)	(0.795 – 0.880)
	8.37 (8)	19.8 – 22.4	21.1 – 23.6	23.5 – 26.7	25.4 – 29.2
		(0.780 – 0.880)	(0.830 – 0.930)	(0.925 – 1.05)	(1.00 – 1.15)
	10.6 (7)	21.8 – 24.3	23.0 – 25.6	25.0 – 28.9	27.4 – 31.2
		(0.860 – 0.960)	(0.909 – 1.01)	(0.988 – 1.14)	(1.08 – 1.23)
	13.3 (6)	23.4 – 26.7	24.6 – 27.9	26.7 – 30.5	30.0 – 33.8
		(0.920 – 1.05)	(0.970 – 1.10)	(1.05 – 1.20)	(1.18 – 1.33)
	16.8 (5)	25.2 – 29.2	26.7 – 30.5	29.2 – 33.0	31.8 – 35.6
		(0.994 – 1.15)	(1.05 – 1.20)	(1.15 – 1.30)	(1.25 – 1.40)
	21.1 (4)	26.9 – 30.7	28.7 – 32.5	31.8 – 36.8	–
		(0.106 – 1.21)	(1.13 – 1.28)	(1.25 – 1.45)	–
	26.7 (3)	29.2 – 33.0	31.0 – 34.8	33.8 – 38.9	–
		(1.15 – 1.30)	(1.22 – 1.37)	(1.33 – 1.53)	–
	33.6 (2)	30.7 – 35.6	33.0 – 38.1	36.8 – 41.9	–
		(1.21 – 1.40)	(1.30 – 1.50)	(1.45 – 1.65)	–

** Diameters of constructions that are not covered in the table are not specified.*

Notes:

(1) *When a metal support member in accordance with Clause 4.1.11 or coiled types or mixed conductor sizes as described in Clauses 4.1.8.2 and 4.1.1.1, respectively, are included, the maximum diameters in this table do not apply.*

(2) *The above tabulated diameters do not apply to a cord that is intended for application in which*
i) a fitting is moulded on each end of the cord; or
ii) a fitting is moulded onto one end of the cord and a means of strain relief is moulded on towards the other end of the cord.

(3) *Cord types with the suffix "-B" shall be measured under the braid.*

Table 14
Dimensions of two- and three-conductor thermoset parallel types

(See Clauses 4.2.1, 4.2.3.1, 4.2.7.1, and 4.2.10, and Figure 1 – Figure 5.)

		Type								
		SP-1	**NISP-1**	**SP-2**	**NISP-2**	**SP-3**	**SP-3**	**SP-3**	**SP-3**	**SRD[m,u]**
Size, mm^2 (AWG)		0.519 (20) 0.824 (18)	0.519 (20) 0.824 (18)	0.824 (18) 1.04 (17) 1.31 (16) 2.08 (14)*	0.824 (18) 1.04 (17) 1.31 (16)	0.824 (18) 1.31 (16) 1.04 (17)	2.08 (14) 1.65 (15)	3.31 (12)	5.26 (10)	5.26 – 21.2 (10 – 4)
Insulation thickness, mm (mils)	Nominal (not a requirement)	0.76 (30)	N/A	1.14 (45)	N/A	1.52 (60)	2.03 (80)	2.41 (95)	2.79 (110)	N/A
	Minimum acceptable average (Dimension A)	N/A	0.38 (15)	N/A	0.76 (30)	N/A	N/A	N/A	N/A	2.54 (100)
	Minimum thickness at any point (Dimension B)	N/A	0.33 (13)	N/A	0.69 (27)	N/A	N/A	N/A	N/A	N/A
	Minimum thickness at any point before separation (Dimension F)	0.69 (27)	N/A	1.02 (40)	N/A	1.37 (54)	1.83 (72)	2.18 (86)	2.51 (99)	N/A
	Minimum thickness at any point after separation (Dimension G)	0.33 (13)	N/A	0.69 (27)	N/A	1.02 (40)	1.02 (40)	1.02 (40)	1.02 (40)	1.04 (41)
Minimum thickness of web, mm (mils) (Dimension H)		1.14 (45)	N/A	2.03 (80)	N/A	2.79 (110)	2.79 (110)	2.79 (110)	2.79 (110)	2.79 (110)
Minimum distance between insulated conductors, mm (mils) (Dimension E)		N/A	0.38 (15)	N/A	0.51 (20)	N/A	N/A	N/A	N/A	N/A
Minimum distance between conductors for a cord with a grounding conductor, mm (mils) (Dimension K)		0.69 (27)	N/A	1.02 (40)	N/A	1.37 (54)	1.37 (54)	1.37 (54)	1.37 (54)	N/A
Minimum acceptable thickness of insulation on grounding conductor, mm (mils) (Dimension L)		0.38 (15)	N/A	0.38 (15)	N/A	0.38 (15)	0.38 (15)	0.38 (15)	0.38 (15)	N/A

Table 14 Continued on Next Page

Table 14 Continued

	Type								
	SP-1	**NISP-1**	**SP-2**	**NISP-2**	**SP-3**	**SP-3**	**SP-3**	**SP-3**	**SRD[m,u]**
Minimum thickness at any point of insulation on grounding conductor, mm (mils) (Dimension M)	0.33 (13)	N/A	0.33 (13)	N/A	0.33 (13)	0.33 (13)	0.33 (13)	0.33 (13)	N/A
Jacket									
Minimum average mm (mils) (Dimension C)	N/A	0.38 (15)	N/A	0.38 (15)	N/A	N/A	N/A	N/A	N/A
Minimum point thickness, mm (mils) (Dimension D)	N/A	0.33 (13)	N/A	0.33 (13)	N/A	N/A	N/A	N/A	N/A
** 2.08 mm^2 (14 AWG) SP-2 is for use in Mexico only.*									

Table 15
Thermoset service cords

(See Clauses 4.2.1, 4.2.3.1, 4.2.7.1, and 4.2.10, and Figure 3 and Figure 4.)

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SV, SVO, SVOO	SP-1, SP-2, SP-3	NISP-1, NISP-2	SJ, SJO, SJOO, SJOW, SJOOW	S, SO, SOO, SOW, SOOW
Temperature ratings, °C	60, 75, 90	60	60	60, 75, 90, 105	60, 75, 90, 105
Maximum voltage, V	300	300	300	300	600
Size of conductors, mm^2 (AWG)	0.824, 1.04, 1.31 (18, 17, 16)	0.519, 0.824 (SP-1) (20, 18) (SP-1) 0.824 – 1.31 (SP-2) (18 – 16), (SP-2) 0.824 – 5.26 (SP-3) (18 – 10) (SP-3)	0.824 – 1.31 (NISP-2) (18 – 16) (NISP-2) 0.59, 0.824 (NISP-1) (20, 18) (NISP-1)	0.824 – 5.26 (18 – 10)	0.824 – 33.6 (18 – 2)
Number of conductors	2 or 3	2 or 3	2 or 3	2 – 6	2 or more
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8
Conductor:					
Material	Soft, annealed copper (Clause 4.1.1.2)				
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)				
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)				
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)				
Insulation class, Clause	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2
Circuit conductor					
60°C	1, 13	1, 13	1, 13	1, 13	1, 13
75°C	2	N/A	N/A	2	2
90°C	3, 12	N/A	N/A	3, 12	3, 12

Table 15 Continued on Next Page

Table 15 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SV, SVO, SVOO	SP-1, SP-2, SP-3	NISP-1, NISP-2	SJ, SJO, SJOO, SJOW, SJOOW	S, SO, SOO, SOW, SOOW
105°C	N/A	N/A	N/A	18, 19	18, 19
Grounding (bonding) conductor:					
60°C	1, 13	1, 10	1, 10	1, 13	1, 13
75°C	2	N/A	N/A	2	2
90°C	3, 12	N/A	N/A	3, 12	3, 12
105°C	N/A	N/A	N/A	18, 19	18, 19
Minimum average thickness, mm (mils)	0.38 (15)	Table 14	Table 14	0.824 – 4.17 mm^2 (18 – 11 AWG) = 0.76 (30) 5.26 mm^2 (10 AWG) = 1.14 (45)	0.824 – 1.65 mm^2 (18 – 15 AWG) = 0.76 (30) 2.08 – 6.63 mm^2 (14 – 9 AWG) = 1.14 (45) 8.37 mm^2 – 33.6 mm^2 (8 AWG – 2 AWG) = 1.52 (60)
Minimum thickness at any point	90 percent of min. avg.	Table 14	Table 14	90 percent of min. avg.	90 percent of min. avg.
Minimum thickness at point of contact between conductors	80 percent of min. avg.	N/A	N/A	80 percent of min avg.	80 percent of min avg.
Covering on individual conductors (optional), Clause	4.1.3	N/A	N/A	4.1.3	4.1.3
Assembly, Clause	4.1.4	Parallel	Parallel	4.1.4	4.1.4
Optional shielding, Clause	4.1.5	N/A	4.1.5	4.1.5	4.1.5
Jacket class:					
60°C	1.1*, 1.2	N/A	1.1, 1.2	1.1**. 1.2	1.1 †1.2
75°C	1.3	N/A	N/A	1.3	1.3
90°C	1.4	N/A	N/A	1.4	1.4
105°C	N/A	N/A	N/A	1.12	1.12
Minimum and average thickness of jacket,	Table 54	N/A	Table 14	Table 54, Table 55	Table 56, Table 57, Table 58
General Clause	4.1.6	N/A	4.1.6	4.1.6	4.1.6
Overall diameter, Clause	4.1.7	N/A	N/A	4.1.7	4.1.7

Table 15 Continued on Next Page

Table 15 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SV, SVO, SVOO	SP-1, SP-2, SP-3	NISP-1, NISP-2	SJ, SJO, SJOO, SJOW, SJOOW	S, SO, SOO, SOW, SOOW
Overall braid	Cords with "-B" suffix only, Clause 4.2.8				
Conductor identification, Clause	4.1.9	4.1.9	4.1.9	4.1.9	4.1.9
Tests, Clause:					
Insulation resistance	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Spark	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
Mechanical strength	5.1.4	N/A	N/A	5.1.4	5.1.4
Flexing of shielded cords	5.2.9	N/A	5.2.9	5.2.9	5.2.9
Jacket resistance	5.2.10	N/A	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8
Bend test, nylon covered	5.1.9	–	5.1.9	5.1.9	5.1.9
Tightness of insulation, Clause	N/A	5.1.10	N/A	N/A	N/A
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, VW-1	5.1.5	5.1.5	5.1.5	5.1.5	5.1.5
Physical properties,					
Insulation	Table 9	Table 9	Table 9	Table 9	Table 9
Jacket	Table 12	N/A	Table 12	Table 12	Table 12
Additional tests for "W" type cords, Clause					
Weather resistance	N/A	N/A	N/A	5.1.7	5.1.7
Insulation resistance	N/A	N/A	N/A	5.2.3.1	5.2.3.1
Permittivity and stability factor	N/A	N/A	N/A	5.2.4	5.2.4
Swelling and blistering	N/A	N/A	N/A	5.1.11	5.1.11

Table 15 Continued on Next Page

Table 15 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SV, SVO, SVOO	SP-1, SP-2, SP-3	NISP-1, NISP-2	SJ, SJO, SJOO, SJOW, SJOOW	S, SO, SOO, SOW, SOOW
Additional tests for cords suffixed "-B" Clause:					
Flexibility of braid	5.1.15	5.1.15	5.1.15	5.1.15	5.1.15
Additional tests for cords marked "R", Clause:					
Abrasion Test	5.1.14	5.1.14	5.1.14	5.1.14	N/A
Mandrel Pinching Test	5.1.16	5.1.16	5.1.16	5.1.16	N/A
Mandrel Crushing Test	5.1.17	5.1.17	5.1.17	5.1.17	N/A
Flexing Test	5.1.18	5.1.18	5.1.18	5.1.18	N/A

** For SV only.*

***For SJ only.*

† For S only.

Table 16
Dryer and range cords

(See Clauses 4.2.1, 4.2.3.1, 4.2.7.1, 4.3.1, 4.3.3.1, 4.3.7.1, and 4.3.10.3.)

	Type			
	SRD[m,u]	SRDE[m,u]	SRDT[m,u]	DRT[c]
Temperature ratings, °C	60	90, 105	60, 75, 90, 105	60, 90
Maximum voltage, V	300	300	300	300
Size of conductors, mm^2 (AWG)	5.26 – 21.2 (10 – 4)	5.26 – 21.2 (10 – 4)	5.26 – 21.2 (10 – 4)	5.26 – 21.2 (10 – 4)
Number of conductors	3 – 4*	3 – 4*	3 – 4*	4
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8
Conductor:				
Material	Soft, annealed copper (Clause 4.1.1.2)			
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)			
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)			
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)			
Assembly	Twisted or parallel	Twisted or parallel	Twisted or parallel	Twisted
Shielding (optional), twisted only, Clause	4.1.5	4.1.5	4.1.5	4.1.5
Insulation class:				
60°C	1	N/A	4	4,14
75°C	N/A	N/A	5	N/A
90°C	N/A	15	6	6
105°C	N/A	16	7	N/A
Minimum acceptable average thickness, twisted only, mm (mils)	1.14 (45)	1.14 (45)	1.14 (45)	1.14 (45)
Minimum thickness	90 percent of min. acceptable average; 80 percent of min. acceptable average at point of contact			
Covering on individual conductors (optional), Clause	4.3.4	4.3.4	4.3.4	4.3.4
Insulation/jacket class, parallel only	1.1, 1.2	1.10, 1.11	1.5, 1.6, 1.7, 1.8	N/A
Jacket class, twisted only	1.1	(90) 1.10	(60) 1.5	(60) 1.5
		(105) 1.11	(75) 1.6	
			(90) 1.7	(90) 1.7
			(105) 1.8	
Minimum and minimum average thickness of jacket, twisted only:				
Minimum average thickness, mm (mils)	1.52 (60)	1.52 (60)	1.52 (60)	1.52 (60)
Minimum thickness, mm (mils)	1.21 (48)	1.21 (48)	1.21 (48)	1.21 (48)
Thicknesses of parallel construction, Clause	4.3.10.5	4.3.10.5	4.3.10.5	–
Tests, Clause:				
Insulation resistance	5.2.3	5.2.3	5.2.3	5.2.3
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6
Heat-shock resistance	N/A	5.1.8	5.1.8	5.1.8

Table 16 Continued on Next Page

Table 16 Continued

	Type			
	SRD[m,u]	SRDE[m,u]	SRDT[m,u]	DRT[c]
Tightness of insulation[†]	5.1.10.3	5.1.10.3	5.1.10.3	N/A
Spark	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7
Jacket resistance	5.2.10	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8
Deformation	N/A	5.1.3	5.1.3	5.1.3
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, VW-1	5.1.5	5.1.5	5.1.5	5.1.5
Physical properties:				
Insulation	Table 9	Table 9	Table 9	Table 9
Jacket and integral (parallel)	Table 12	Table 12	Table 12	Table 12
Additional tests for cords marked "-R", Clause:				
Abrasion	5.1.14	5.1.14	5.1.14	–
Mandrel pinching	5.1.16	5.1.16	5.1.16	–
Mandrel crushing	5.1.17	5.1.17	5.1.17	–
Flexing	5.1.18	5.1.18	5.1.18	–

** For three-conductor cords, parallel (integral) construction shall be permitted.*

[†] For integral, parallel constructions only.

Table 17
Special-use cords

(See Clauses 4.2.1 and 4.2.3.1.)

	Type	
	C[u]	PD[u]
Maximum temperature, °C	60	60
Maximum voltage, V	300*	300*
Size of conductors, mm^2 (AWG)	0.824 – 5.26 (18 – 10)	0.824 – 5.26 (18 – 10)
Number of conductors	2 or more	2 or more
Grounding conductor, Clause	4.1.1.8	4.1.1.8
Conductor:		
Material	Soft, annealed copper (Clause 4.1.1.2)	
Size	Cross-sectional area (Clause 4.1.1.3)	
Stranding	Size of wires (Clause 4.1.1.7), Lay of wires (Clause 4.1.1.7.2)	
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)	
Insulation class (Table 8 and Clause 4.1.2)	1, 13	1, 13

Table 17 Continued on Next Page

Table 17 Continued

	Type	
	C[u]	PD[u]
Minimum average thickness, mm^2 (AWG) = mm (mils)	0.824 − 1.31 (18 − 16) = 0.76 (30) 1.65 − 5.26 (15 − 10) = 1.14 (45)	
Minimum thickness	90 percent of minimum average	
Covering on individual conductors (optional), Clause	Cotton or rayon braid 4.3.4	Cotton or rayon braid 4.3.4
Assembly of conductors	Twisted	Twisted
Overall fibrous braid (Clause)	N/A	Cotton or rayon (4.1.3.2)
Braid saturation	N/A	Optional (4.1.3.2.5)
Tests, Clause:		
Physical properties, insulation:	Table 9	Table 9
Cold bend	5.1.6	5.1.6
Flexibility of braid	5.1.15	5.1.15
Spark	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2
Insulation resistance	5.2.3	5.2.3
Continuity	5.2.7	5.2.7
Copper corrosion	5.2.8	5.2.8
Flame (FT2)	5.1.5.3	5.1.5.3
(Optional) FT1, VW-1	5.1.5.1, 5.1.5.4	5.1.5.1, 5.1.5.4

** The maximum voltage is 600 provided that the average thickness of insulation on the individual conductors is at least 1.14 mm (45 mils).*

Table 18
Dimensions of two- and three-conductor thermoplastic parallel types

(See Clauses 4.3.1, 4.3.3.1, 4.3.7.1, 4.3.10.3, and 4.3.11, Table 20, and Figure 1 – Figure 5.)

		Type										
		SPT-1	**NISPT-1**	**SPT-2**	**NISPT-2**	**SPT-3**	**SPT-3**	**SPT-3**	**SPT-3**	**SPT-0[m]**	**SRDT**	**DPTW[c,u], DPT[c,u]**
Size range, mm^2 (AWG)		0.519 (20) 0.824 (18)	0.519 (20) 0.824 (18)	0.824 (18) 1.04 (17) 1.31 (16) 2.08 (14)*	0.824 (18) 1.04 (17) 1.31 (16)	0.824 (18) 1.04 (17) 1.31 (16)	2.08 (14) 1.65 (15)	3.31 (12)	5.26 (10)	0.325 (22)	5.26 – 21.2 (10 – 4)	0.519 (20)
Insulation thickness, mm (mils)	Nominal (not a requirement)	0.76 (30)	N/A	1.14 (45)	N/A	1.52 (60)	2.03 (80)	2.41 (95)	2.79 (110)	0.64 (25)	N/A	1.14 (45)
	Minimum acceptable average (Dimension A)	N/A	0.38 (15)	N/A	0.76 (30)	N/A	N/A	N/A	N/A	N/A	2.54 (100)	N/A
	Minimum thickness at any point (Dimension B)	N/A	0.33 (13)	N/A	0.69 (27)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Minimum thickness at any point before separation (Dimension F)	0.69 (27)	N/A	1.02 (40)	N/A	1.37 (54)	1.83 (72)	2.18 (86)	2.51 (99)	0.58 (23)	N/A	1.02 (40)
	Minimum thickness at any point after separation (Dimension G)	0.33 (13)	N/A	0.69 (27)	N/A	1.02 (40)	1.02 (40)	1.02 (40)	1.02 (40)	0.28 (11)	1.04 (41)	0.69 (27)
Minimum thickness of web, mm (mils) (Dimension H)		1.14 (45)	N/A	2.03 (80)	N/A	2.79 (110)	2.79 (110)	2.79 (110)	2.79 (110)	0.96 (38)	2.79 (110)	2.03 (80)
Minimum distance between insulated conductors, mm (mils) (Dimension E)		N/A	0.38 (15)	N/A	0.51 (20)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Minimum distance between conductors for a cord with a grounding conductor, mm (mils) (Dimension K)		0.69 (27)	N/A	1.02 (40)	N/A	1.37 (54)	1.37 (54)	1.37 (54)	1.37 (54)	0.58 (23)	N/A	1.02 (40)

Table 18 Continued on Next Page

Table 18 Continued

	Type										
	SPT-1	NISPT-1	SPT-2	NISPT-2	SPT-3	SPT-3	SPT-3	SPT-3	SPT-0[m]	SRDT	DPTW[c,u], DPT[c,u]
Minimum acceptable thickness of insulation on grounding conductor, mm (mils) (Dimension L)	0.38 (15)	N/A	0.38 (15)	N/A	0.38 (15)	0.38 (15)	0.38 (15)	0.38 (15)	N/A	N/A	0.38 (15)
Minimum thickness at any point of insulation on grounding conductor, mm (mils) (Dimension M)	0.33 (13)	N/A	0.33 (13)	N/A	0.33 (13)	0.33 (13)	0.33 (13)	0.33 (13)	N/A	N/A	0.33 (13)
Jacket:											
Minimum average mm (mils) (Dimension C)	N/A	0.38 (15)	N/A	0.38 (15)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Minimum thickness, mm (mils) (Dimension D)	N/A	0.33 (13)	N/A	0.33 (13)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
** 2.08 mm^2 (14 AWG) SPT-2 is for use in Mexico only.*											

Table 19
Dimensions of two- and three-conductor thermoplastic elastomer parallel types

(See Clauses 4.3.1, 4.3.3.1, 4.3.7.1, 4.3.10.3, and 4.3.11, Table 21 and Figure 1 – Figure 5.)

		Type								
		SPE-1	**NISPE-1**	**SPE-2**	**NISPE-2**	**SPE-3**	**SPE-3**	**SP-3**	**SPE-3**	**SRDE[m,u]**
Size, mm^2 (AWG)		0.519 (20) 0.824 (18)	0.519 (20) 0.824 (18)	0.824 (18) 1.04 (17) 1.31 (16)	0.824 (18) 1.04 (17) 1.31 (16)	0.824 (18) 1.04 (17) 1.31 (16)	2.08 (14) 1.65 (15)	3.31 (12)	5.26 (10)	5.26 – 21.2 (10 – 4)
Insulation thickness, mm (mils)	Nominal (not a requirement)	0.76 (30)	N/A	1.14 (45)	N/A	1.52 (60)	2.03 (80)	2.41 (95)	N/A	N/A
	Minimum acceptable average (Dimension A)	N/A	0.38 (15)	N/A	0.76 (30)	N/A	N/A	N/A	N/A	2.54 (100)
	Minimum thickness at any point (Dimension B)	N/A	0.33 (13)	N/A	0.69 (27)	N/A	N/A	N/A	N/A	N/A
	Minimum thickness at any point before separation (Dimension F)	0.69 (27)	N/A	1.02 (40)	N/A	1.37 (54)	1.83 (72)	2.18 (86)	N/A	N/A
	Minimum thickness at any point after separation (Dimension G)	0.33 (13)	N/A	0.69 (27)	N/A	1.02 (40)	1.02 (40)	1.02 (40)	1.024 (41)	1.04 (41)
Minimum thickness of web, mm (mils) (Dimension H)		1.14 (45)	N/A	2.03 (80)	N/A	2.79 (110)	2.79 (110)	2.79 (110)	2.79 (110)	2.79 (110)
Minimum distance between insulated conductors, mm (mils) (Dimension E)		N/A	0.38 (15)	N/A	0.51 (20)	N/A	N/A	N/A	N/A	N/A
Minimum distance between conductors for a cord with a grounding conductor, mm (mils) (Dimension K)		0.69 (27)	N/A	1.02 (40)	N/A	1.37 (54)	1.37 (54)	1.37 (54)	1.37 (54)	N/A
Minimum acceptable thickness of insulation on grounding conductor, mm (mils) (Dimension L)		0.38 (15)	N/A	0.38 (15)	N/A	0.38 (15)	0.38 (15)	0.38 (15)	0.38 (15)	N/A

Table 19 Continued on Next Page

Table 19 Continued

	Type								
	SPE-1	**NISPE-1**	**SPE-2**	**NISPE-2**	**SPE-3**	**SPE-3**	**SP-3**	**SPE-3**	**SRDE[m,u]**
Minimum thickness at any point of insulation on grounding conductor, mm (mils) (Dimension M)	0.33 (13)	N/A	0.33 (13)	N/A	0.33 (13)	0.33 (13)	0.33 (13)	0.33 (13)	N/A
Jacket									
Minimum average mm (mils) (Dimension C)	N/A	0.38 (15)	N/A	0.38 (15)	N/A	N/A	N/A	N/A	N/A
Minimum thickness, mm (mils) (Dimension D)	N/A	0.33 (13)	N/A	0.33 (13)	N/A	N/A	N/A	N/A	N/A

Table 20
Thermoplastic service cords

(See Clauses 4.3.1, 4.3.3.1, 4.3.7.1, 4.3.10.3, and 4.3.11.)

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVT, SVTO, SVTOO	SPT-1, SPT-1W[c,u], SPT-2, SPT-2W[c,u], SPT-3	NISPT-1, NISPT-2	SJT, SJTO, SJTW, SJTOW, SJTOOW, SJTOO,	ST, STO, STOO, STW, STOW, STOOW
Temperature ratings, °C	60, 75, 90, 105	60, 75, 90, 105§	60, 75, 90, 105	60, 75, 90, 105	60, 75, 90, 105
Maximum voltage, V	300	300	300	300	600
Size of conductors, mm^2 (AWG)	0.824, 1.04, 1.31 (18, 17, 16)	0.519, 0.824 (SPT-1, SPT-1W[c,u]) (20, 18) (SPT-1, SPT-1W[c,u]) 0.824 – 1.31, 2.08* (SPT-2, SPT-2W[c,u]) (18 – 16, 14*) (SPT-2, SPT-2W[c,u]) 0.824 – 5.26 (SPT-3) (18 – 10) (SPT-3)	0.519, 0.824 (NISPT-1) (20 ,18) (NISPT-1) 0.824 – 1.31 (NISPT-2) (18 – 16) (NISPT-2)	0.824 – 5.26 (18 – 10)	0.824 – 33.6 (18 – 2)
Number of conductors	2 or 3	2 or 3	2 or 3	2 – 6	2 or more
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8
Conductor:					
Material	Soft, annealed copper (Clause 4.1.1.2)				
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)				
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)				
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)				
Insulation class, Clause	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2
Circuit conductor:					
60°C	4	4	4	4, 8***	4, 8***
75°C	5	5	5	5, 9***	5, 9***
90°C	6	6	6	6	6

Table 20 Continued on Next Page

Table 20 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVT, SVTO, SVTOO	SPT-1, SPT-1W[c,u], SPT-2, SPT-2W[c,u], SPT-3	NISPT-1, NISPT-2	SJT, SJTO, SJTW, SJTOW, SJTOOW, SJTOO,	ST, STO, STOO, STW, STOW, STOOW
105°C	7	7	7	7, 20***	7, 20***
Grounding conductor:					
60°C	4	4, 8	4, 8	4, 8***	4, 8***
75°C	5	5, 9	5, 9	5, 9***	5, 9***
90°C	6	6, 10	6, 10	6	6
105°C	7	7, 11	7, 11	7, 20***	7, 20***
Minimum average thickness, mm (mils)	0.38 (15)	Table 18	Table 18	0.824 – 4.17 mm^2 (18 – 11 AWG) = 0.76 (30) 5.26 mm^2 (10 AWG) = 1.14 (45)	0.824 – 1.65 mm^2 (18 – 15 AWG) = 0.76 (30) 2.08 – 6.63 mm^2 (14 – 9 AWG) = 1.14 (45) 8.37 mm^2 – 33.6 mm^2 (8 AWG – 2 AWG) = 1.52 (60)
Minimum thickness at any point,	90 percent of min. avg.	Table 18	Table 18	90 percent of min. avg.	90 percent of min. avg.
Minimum thickness at point of contact	80 percent of min. avg.	N/A	N/A	80 percent of min. avg.	80 percent of min. avg.
Covering on individual conductors (optional), Clause	4.1.3	4.3.10.4	4.1.3	4.1.3	4.1.3
Assembly, Clause	4.1.4	Parallel	Parallel	4.1.4	4.1.4
Optional shielding, Clause	4.1.5	N/A	4.1.5	4.1.5	4.1.5
Jacket class:					
60°C	1.5	N/A	1.5	1.5	1.5
75°C	1.6	N/A	1.6	1.6	1.6
90°C	1.7	N/A	1.7	1.7	1.7
105°C	1.8	N/A	1.8	1.8	1.8
Minimum and average thickness of jacket,	Table 54	N/A	Table 18	Table 54, Table 55	Table 56, Table 57, Table 58
General, Clause	4.1.6	NA	4.1.6	4.1.6	4.1.6

Table 20 Continued on Next Page

Table 20 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVT, SVTO, SVTOO	SPT-1, SPT-1W[c,u], SPT-2, SPT-2W[c,u], SPT-3	NISPT-1, NISPT-2	SJT, SJTO, SJTW, SJTOW, SJTOOW, SJTOO,	ST, STO, STOO, STW, STOW, STOOW
Overall braid	Cords with "-B" suffix only, 4.3.8				
Overall diameter, Clause	4.1.7	NA	NA	4.1.7	4.1.7
Conductor identification, Clause	4.1.9	4.1.9	4.1.9	4.1.9	4.1.9
Tests, Clause:					
Insulation resistance	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Bend test, nylon-covered	5.1.9	5.1.9	5.1.9	5.1.9	5.1.9
Heat-shock resistance	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8
Spark	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
AC leakage current	N/A	N/A	N/A	5.2.11	5.2.11
Mechanical strength	5.1.4	NA	NA	5.1.4	5.1.4
Flexing of shielded cords	5.2.9	NA	5.2.9	5.2.9	5.2.9
Jacket resistance	5.2.10	NA	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8
Deformation	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3
Tightness of insulation, Clause	N/A	5.1.10	N/A	N/A	N/A
Flame (FT2)	5.1.5.3	5.1.5.3#	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, VW-1	5.1.5	5.1.5#	5.1.5	5.1.5	5.1.5
Physical properties:					
Insulation	Table 9	Table 9	Table 9	Table 9	Table 9
Jacket	Table 12	Table 12	Table 12	Table 12	Table 12
Additional tests for cords suffixed "-B", Clause:					

Table 20 Continued on Next Page

Table 20 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVT, SVTO, SVTOO	SPT-1, SPT-1W[c,u], SPT-2, SPT-2W[c,u], SPT-3	NISPT-1, NISPT-2	SJT, SJTO, SJTW, SJTOW, SJTOOW, SJTOO,	ST, STO, STOO, STW, STOW, STOOW
Flexibility of braid	5.1.15	5.1.15	5.1.15	5.1.15	5.1.15
Additional tests for "W" type cords, Clause:					
Weather resistance	N/A	5.1.7	N/A	5.1.7	5.1.7
Insulation resistance	N/A	5.2.3.1	N/A	5.2.3.1	5.2.3.1
Permittivity and stability factor	N/A	5.2.4	N/A	5.2.4	5.2.4
Additional tests for cords marked "-R", Clause:					
Abrasion	5.1.14	5.1.14	5.1.14	5.1.14	N/A
Mandrel pinching	5.1.16	5.1.16	5.1.16	5.1.16	N/A
Mandrel crushing	5.1.17	5.1.17	5.1.17	5.1.17	N/A
Flexing	5.1.18	5.1.18	5.1.18	5.1.18	N/A

** 2.08 mm^2 (14 AWG) SPT-2 is for use in Mexico only.*

**** For types SJT, SJTO, ST and STO marked low leakage only.*

§ SPT-1W[c,u] and SPT-2W[c,u] rated 105°C may be used as decorative cords for use in the United States only.

 # For flame test requirements for Mexico, see Clause 4.3.10.6.

Table 21
Thermoplastic elastomer service cords

(See Clauses 4.3.1, 4.3.3.1, 4.3.7.1, 4.3.10.3, and 4.3.11.)

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVE, SVEO, SVEOO	SPE-1, SPE-2, SPE-3	NISPE-1[m,u], NISPE-2	SJE, SJEO, SJEW, SJEOW, SJEOOW, SJEOO	SE, SEO, SEOO, SEW, SEOW, SEOOW
Temperature ratings, °C	90, 105	90, 105	90, 105	90, 105	90, 105
Maximum voltage, V	300	300	300	300	600
Size of conductors, mm^2 (AWG)	0.824, 1.04, 1.31 (18, 17, 16)	0.519, 0.824 (SPE-1) (20, 18) (SPE-1) 0.824 – 1.31, (SPE-2) (18 – 16) (SPE-2) 0.824 – 5.26 (SPE-3) (18 – 10) (SPE-3)	0.519, 0.824 (NISPE-1) (20, 18) (NISPE-1) 0.824 – 1.31 (NISPE-2) (18 – 16) (NISPE-2)	0.824 – 5.26 (18 – 10)	0.824 – 33.6 (18 – 2)
Number of conductors	2 or 3	2 or 3	2 or 3	2 – 6	2 or more
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8
Conductor:					
Material	Soft, annealed copper (Clause 4.1.1.2)				
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)				
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)				
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)				
Insulation class, Clause	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2
Circuit conductor:					
90°C	15	15	15	15	15
105°C	16	16	16	16	16
Grounding conductor:					
90°C	N/A	15	15	N/A	N/A
105°C	N/A	16	16	N/A	N/A
Minimum average thickness, mm (mils)	0.38 (15)	Table 19	Table 19	0.824 – 4.17 mm^2 (18 – 11 AWG) = 0.76 (30)	0.824 – 1.65 mm^2 (18 – 15 AWG) = 0.76 (30)

Table 21 Continued on Next Page

Table 21 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVE, SVEO, SVEOO	SPE-1, SPE-2, SPE-3	NISPE-1[m,u], NISPE-2	SJE, SJEO, SJEW, SJEOW, SJEOOW, SJEOO	SE, SEO, SEOO, SEW, SEOW, SEOOW
				5.26 mm^2 (10 AWG) = 1.14 (45);	2.08 – 6.63 mm^2 (14 – 9 AWG) = 1.14 (45) 8.37 mm^2 – 33.6 mm^2 (8 AWG – 2 AWG) = 1.52 (60)
Minimum thickness at any point	90 percent of min. avg.	Table 19	Table 19	90 percent of min avg	90 percent of min avg.
Minimum thickness at point of contact	80 percent of min. avg.	N/A	N/A	80 percent of min. avg.	80 percent of min. avg.
Covering on individual conductors (optional), Clause	4.1.3	NA	NA	4.1.3	4.1.3
Assembly, Clause	4.1.4	4.3.10	4.3.11	4.1.4	4.1.4
Optional shielding, Clause	4.1.5	N/A	4.1.5	4.1.5	4.1.5
Jacket class:					
90°C	1.10	N/A	1.10	1.10	1.10
105°C	1.11	N/A	1.11	1.11	1.11
Minimum and average Thickness of jacket, Table	Table 54	N/A	Table 19	Table 54, Table 55	Table 56, Table 57, Table 58
Overall braid	Cords with "-B" suffix only, Clause 4.3.8				
General, Clause	4.1.6	N/A	4.1.6	4.1.6	4.1.6
Overall diameter, Clause	4.1.7	N/A	N/A	4.1.7	4.1.7
Conductor identification, Clause	4.1.9	4.1.9	4.1.9	4.1.9	4.1.9
Tests, Clause:					
Insulation resistance	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Heat-shock resistance	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8
Spark	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1

Table 21 Continued on Next Page

Table 21 Continued

	Type				
	Not for hard usage			Hard usage	Extra-hard usage
	SVE, SVEO, SVEOO	SPE-1, SPE-2, SPE-3	NISPE-1[m,u], NISPE-2	SJE, SJEO, SJEW, SJEOW, SJEOOW, SJEOO	SE, SEO, SEOO, SEW, SEOW, SEOOW
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
Mechanical strength	5.1.4	N/A	N/A	5.1.4	5.1.4
Flexing of shielded cords	5.2.9	N/A	5.2.9	5.2.9	5.2.9
Jacket resistance	5.2.10	N/A	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8
Deformation	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3
Tightness of insulation, Clause	N/A	5.1.10	N/A	N/A	N/A
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, VW-1	5.1.5	5.1.5	5.1.5	5.1.5	5.1.5
Physical properties:					
Insulation	Table 9	Table 9	Table 9	Table 9	Table 9
Jacket	Table 12	N/A	Table 12	Table 12	Table 12
Additional tests for "W" type cords, Clause:					
Weather resistance	N/A	N/A	N/A	5.1.7	5.1.7
Insulation resistance	N/A	N/A	N/A	5.2.3.1	5.2.3.1
Permittivity and stability factor	N/A	N/A	N/A	5.2.4	5.2.4
Additional tests for cords suffixed "-B", Clause:					
Flexibility of braid	5.1.15	5.1.15	5.1.15	5.1.15	5.1.15
Additional tests for cords marked "-R", Clause:					
Abrasion	5.1.14	5.1.14	5.1.14	5.1.14	N/A
Mandrel pinching	5.1.16	5.1.16	5.1.16	5.1.16	N/A
Mandrel crushing	5.1.17	5.1.17	5.1.17	5.1.17	N/A
Flexing	5.1.18	5.1.18	5.1.18	5.1.18	N/A

Table 22
Decorative cords

(See Clauses 4.3.1, 4.3.3.1, and 4.3.10.3, and Figure 2.)

	Type					
	PXT[c]	**PXWT[c]**	**TX[c]**	**CXWT[c]**	**CXWT[c]**	**SPT-0[m]**
Maximum temperature, °C	60	60	60	60	60	60, 75, 90, 105
Maximum voltage, V	125	300	125	300	600	300
Size of conductors, mm^2 (AWG)	0.325 and 0.519 (22 and 20)	0.325, 0.519, 0.824, and 1.31 (22, 20, 18, and 16)	0.519 (20)	0.325, 0.519, 0.824, and 1.31 (22, 20, 18, and 16)	2.08 and 3.31 (14 and 12)	0.325 (22)
Number of conductors	2	2	2	2***	2***	2 or 3
Conductor:						
Material	Soft annealed copper (Clause 4.1.1.2)					
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)					
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)					
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)					
Conductor identification, Clause	4.1.9	4.1.9	N/A	N/A	N/A	4.1.9
Maximum lay of conductors, Clause	N/A	N/A	4.1.4.1	4.1.4.1	4.1.4.1	N/A
Insulation class	4	4	4	4	4	4, 5, 6, 7
Minimum average thickness, mm (mils)	0.76 (30)*	1.14 (45)*	0.58 (23)	1.14 (45)	1.52 (60)	0.64 (25)*
Minimum thickness (before separation for parallel), mm (mils)	0.69 (27)	1.02 (40)	N/A	N/A	N/A	0.58 (23)
Minimum average thickness (after separation), mm (mils)	0.33 (13)	1.02 (40)	N/A	N/A	N/A	0.28 (11)
Minimum web thickness, mm (mils)	1.14 (45)	2.16 (85)	N/A	N/A	N/A	0.96 (38) (2 conductors);
						0.58 (23) (3 conductors)
Assembly	Parallel integral	Parallel integral	Twisted	Twisted***	Twisted***	Parallel integral
Tests, Clause:						

Table 22 Continued on Next Page

Table 22 Continued

	Type					
	PXT[c]	PXWT[c]	TX[c]	CXWT[c]	CXWT[c]	SPT-0[m]
Physical properties, insulation	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1
Deformation	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3
Spark test	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	N/A	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
Flame FT2	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3
Flame VW-1 (optional)	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4**
Flame FT1 (optional)	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1
FT4 (optional)	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Weather resistance	N/A	5.1.7	N/A	5.1.7	5.1.7	N/A
Durability of print	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Heat-shock resistance	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8
Insulation resistance	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3
Permittivity and stability factor	N/A	5.2.4	N/A	5.2.4	5.2.4	N/A
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8
Tightness of insulation	5.1.10	5.1.10	N/A	5.1.10	5.1.10	5.1.10
Application	Indoor	Outdoor	Indoor	Outdoor	Outdoor	Indoor

** This value is provided for information only. It is not a requirement.*

*** For flame test requirements for Mexico, see Clause 4.3.10.6.*

**** A manufacturer is only permitted to manufacture and sell the single conductor components of a two-conductor CXWT product to a user who will ensure that it is used only in the fabrication of two-conductor twisted CXWT lighting strings. Packaging of single conductor CXWT shall be marked "Not for sale to the general public and restricted for use only in a two-conductor CXWT twisted lighting string.".*

Table 23
Decorative cords and clock cords

(See Clauses 4.3.1, 4.3.3.1, and 4.3.10.3.)

	Type									
	XTW[u]	**CXTW[u]**	**CXTW[u]**	**YXTW[u]**	**LXTW[u]**	**LXT[u]**	**SPT-1W[c,u]**	**DPTW[c,u]**	**DPT[c,u]**	**Clock [u]**
Maximum temperature, °C	105	105	105	105	60	60	105	105	105	60, 105
Maximum voltage, V	300	300	300	300	300	300	300	300	300	125
Size of conductors, mm^2 (AWG)	0.325, 0.519 and 0.824 (22, 20 and 18)	0.325, 0.519 and 0.824 (22, 20, and 18)	0.162, 0.205, and 0.259 (25, 24, 23)# 0.325, 0.519 and 0.824 (22, 20, and 18)	0.519 (20) and 0.824 (18)	0.162, 0.205, and 0.259 (25, 24, 23)# 0.325, 0.519 and 0.824 (22, 20, and 18)	0.162, 0.205, and 0.259 (25, 24, 23)# 0.325, 0.519 and 0.824 (22, 20, and 18)	0.519 and 0.824 (20 and 18)	0.519 (20)	– 0.519 (20)	0.519 (20)
Number of conductors	2 – 6	2	1	1	1	1	2	2	2	2
Conductor:										
Material	Soft annealed copper (Clause 4.1.1.2)									
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)									
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)									
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)									
Conductor identification	4.1.9	4.1.9	4.1.9	N/A	N/A	N/A	4.1.9	4.1.9	4.1.9	N/A
Maximum lay of conductors	N/A	4.1.4.1	4.1.4.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Insulation class	7	7	7	7	7	7	7	7	7	4, 7
Minimum average thickness, mm (mils)	0.76 (30)*	0.76 (30)	0.76 (30)	1.14 (45)*	0.76 (30)	0.76 (30)	0.76 (30)*	1.14 (45)*	1.14 (45)*	0.76 (30)*
Minimum thickness (before separation for parallel), mm (mils)	0.69 (27)	0.69 (27)	N/A	N/A	0.69 (27)	0.69 (27)	0.69 (27)	1.02 (40) 0.69 (27)	1.02(40)	0.69 (27)

Table 23 Continued on Next Page

Table 23 Continued

	Type									
	XTW[u]	CXTW[u]	CXTW[u]	YXTW[u]	LXTW[u]	LXT[u]	SPT-1W[c,u]	DPTW[c,u]	DPT[c,u]	Clock[u]
Minimum thickness after separation, mm (mils)	0.33 (13)	N/A	N/A	N/A	N/A	N/A	0.33 (13)	0.69 (27)	0.69 (27)	0.33 (13)
Minimum web thickness, mm (mils)	1.14 (45)	N/A	N/A	N/A	N/A	N/A	1.14 (45)	2.03 (80)	2.03 (80)	1.14 (45)
Assembly	Parallel integral	Twisted	Single	Single	Single	Single	Parallel integral	Parallel integral	Parallel integral	Parallel integral
Tests, Clause:										
Physical properties, insulation	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1	5.1.1
Deformation	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3	5.1.3
Spark	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
Flame FT2	N/A	N/A	N/A	N/A	N/A	N/A	5.1.5.3 (mandatory)	N/A	N/A	5.1.5.3 (mandatory)
Flame VW-1	5.1.5.4 (mandatory)	5.1.5.4 (mandatory)	5.1.5.4 (mandatory)	5.1.5.4 (mandatory)	5.1.5.4 (mandatory)	5.1.5.4 (mandatory)	5.1.5.4 (optional)	5.1.5.4 (mandatory)	5.1.5.4 (mandatory)	5.1.5.4 (optional)
Flame FT1	5.1.5.1 (optional)	5.1.5.1 (optional)	5.1.5.1 (optional)	5.1.5.1 (optional)	5.1.5.1 (optional)	5.1.5.1 (optional)	5.1.5.1 (optional)	5.1.5.1 (mandatory)	5.1.5.1 (mandatory)	5.1.5.1 (mandatory)
Flame FT4 (optional)	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Weather resistance	5.1.7	5.1.7	5.1.7	5.1.7	5.1.7	N/A	5.1.7	5.1.7	N/A	N/A
Durability of print	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Heat-shock resistance	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8	5.1.8
Insulation resistance	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3	5.2.3
Permittivity and stability factor	5.2.4	5.2.4	5.2.4	5.2.4	5.2.4	N/A	5.2.4	5.2.4	N/A	N/A
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8

Table 23 Continued on Next Page

Table 23 Continued

	Type									
	XTW[u]	CXTW[u]	CXTW[u]	YXTW[u]	LXTW[u]	LXT[u]	SPT-1W[c,u]	DPTW[c,u]	DPT[c,u]	Clock [u]
Tightness of insulation	5.1.10	5.1.10	5.1.10	5.1.10	5.1.10	5.1.10	5.1.10	5.1.10	5.1.10	5.1.10
Additional tests for cords marked "-S":										
Breaking strength	N/A	N/A	5.1.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Addition of tests for cords marked –IS[@]									N/A	
Breaking Strength	N/A	N/A	5.1.24	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Abrasion	N/A	N/A	5.1.20	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Flexing	N/A	N/A	5.1.21	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Examination after conditioning	N/A	N/A	4.3.16.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Additional tests for cords marked "-X":										
Breaking strength	N/A	N/A	5.1.25	N/A	5.1.25	5.1.25	N/A	N/A	N/A	N/A
Application	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Outdoor	Indoor	Indoor

** This value is provided for information only. It is not a requirement.*

 # 0.162 – 0.259 (25 – 23 AWG) for types with "-X" suffix only

[@] Limited to 0.325 mm^2 (22 AWG) only

Table 24
Voltage and leakage currents for surface marking of low-leakage-current service cords

(See Clauses 4.3.14.3 and 6.2.4.)

Voltage source, Vac	Highest rms leakage current in microamperes flowing (separately) between each circuit conductor and the grounding conductor	Highest rms leakage current in microamperes flowing (separately) between each circuit conductor and foil covering to jacket	Values to be used in cord-surface marking		
			Volts	µA to green	µA through jacket
120	0 – 3	0 – 9	120	3	9
120	0 – 5	0 – 12	120	5	12
120	0 – 7	0 – 15	120	7	15
120	0 – 10	0 – 20	120	10	20
240	0 – 6	0 – 18	240	6	18
240	0 – 9	0 – 24	240	9	24
240	0 – 14	0 – 30	240	14	30
240	0 – 20	0 – 40	240	20	40

Table 25
Oil-resistant heater cords

(See Clauses 4.4.3.1, 4.4.5.1, and 4.4.5.2.)

	Type		
	HPN, HPNW[c,u] (not for hard usage)	HSJO, HSJOW (hard usage)	HSJOO, HSJOOW (hard usage)
Maximum temperature, °C	90, 105	90, 105	90, 105
Maximum voltage, V	300	300	300
Size of conductors, mm^2 (AWG)	0.824 – 3.31 (18 – 12)	0.824 – 3.31 (18 – 12)	0.824 – 3.31 (18 – 12)
Number of conductors	2 or 3	2, 3, or 4	2, 3, or 4
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8
Conductor:			
Material	Soft, annealed copper (Clause 4.1.1.2)		
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)		
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)		
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)		
Insulation, Clause	4.1.2	4.1.2	4.1.2
Circuit conductor, Class:			
90°C	12	3, 12	3, 12
105°C	18	18, 19	18, 19
Grounding conductor, Class:			
90°C	3, 10, 12	N/A	N/A
105°C	11, 18, 19	N/A	N/A
Average thickness and minimum thickness at any point,	Table 27 and Table 28	Table 29	Table 29
Assembly of conductors, Clause	4.4.4	4.4.4	4.4.4

Table 25 Continued on Next Page

Table 25 Continued

	Type		
	HPN, HPNW[c,u] (not for hard usage)	HSJO, HSJOW (hard usage)	HSJOO, HSJOOW (hard usage)
Jacket class:			
90°C	N/A	1.4	1.4
105°C	N/A	1.12	1.12
Average thickness and minimum thickness, mm (mils)	N/A	0.76 (30) min. avg.	0.76 (30) min. avg.
	N/A	0.61 (24) min. point	0.61 (24) min. point
Conductor identification, Clause	4.1.9	4.1.9	4.1.9
Tests, Clause:			
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, and VW-1	5.1.5.1, 5.1.5.2, 5.1.5.4	5.1.5.1, 5.1.5.2, 5.1.5.4	5.1.5.1, 5.1.5.2, 5.1.5.4
Insulation resistance	5.2.3	5.2.3	5.2.3
Cold bend	5.1.6	5.1.6	5.1.6
Arcing	5.2.5 and 5.2.6	N/A	N/A
Spark	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7
Durability of printing	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8
Tightness of insulation	5.1.10	N/A	N/A
Jacket resistance	N/A	5.2.10	5.2.10
Physical properties, Table:			
Insulation	Table 9	Table 9	Table 9
Jacket	N/A	Table 12	Table 12
Additional tests for "W" type cords, Clause:			
Weather resistance	5.1.7	5.1.7	5.1.7
Insulation resistance	5.2.3.1	5.2.3.1	5.2.3.1
Permittivity and stability factor	5.2.4	5.2.4	5.2.4
Swelling and blistering	5.1.11	5.1.11	5.1.11
Additional tests for cords marked "-R", Clause:			
Abrasion	5.1.14	5.1.14	5.1.14
Mandrel pinching	5.1.16	5.1.16	5.1.16
Mandrel crushing	5.1.17	5.1.17	5.1.17
Flexing	5.1.18	5.1.18	5.1.18

Table 26
Heater cords

(See Clauses 4.4.3.1, 4.4.5.1, and 4.4.5.2.)

	Type		
	HPD[m,u] (not for hard usage)	**HSJ (hard usage)**	**HSJW[c,u] (hard usage)**
Maximum temperature, °C	90, 105	90, 105	90, 105
Maximum voltage, V	300	300	300
Size of conductors, mm^2 (AWG)	0.824 – 3.31 (18 – 12)	0.824 – 3.31 (18 – 12)	0.824 – 3.31 (18 – 12)
Number of conductors	2, 3 or 4	2, 3, or 4	2, 3, or 4
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8
Conductor:			
Material	Soft, annealed copper (Clause 4.1.1.2)		
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)		
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)		
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)		
Insulation, Clause	4.1.2	4.1.2	4.1.2
Circuit conductor, Class:			
90°C	3, 12	3, 12	3, 12
105°C	18, 19	18, 19	18, 19
Average thickness and minimum thickness at any point,	Table 29	Table 29	Table 29
Insulated conductor braid	4.1.3.2 (optional)	N/A	N/A
Assembly of conductors, Clause	4.4.4	4.4.4	4.4.4
Overall fibrous braid	4.1.3.2	N/A	N/A
Jacket class:			
90°C	N/A	1.4	1.4
105°C	N/A	1.12	1.12
Average thickness and minimum thickness, mm (mils)	N/A	0.76 (30) min. avg.	0.76 (30) min. avg.
	N/A	0.61 (24) min. point	0.61 (24) min. point
Conductor identification, Clause	4.1.9	4.1.9	4.1.9
Tests, Clause:			
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, and VW-1	5.1.5.1, 5.1.5.2, 5.1.5.4	5.1.5.1, 5.1.5.2, 5.1.5.4	5.1.5.1, 5.1.5.2, 5.1.5.4
Insulation resistance	5.2.3	5.2.3	5.2.3
Cold bend	5.1.6	5.1.6	5.1.6
Spark	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7
Durability of printing	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8
Jacket resistance	N/A	5.2.10	5.2.10
Flexibility of braid	5.1.15	N/A	N/A

Table 26 Continued on Next Page

Table 26 Continued

	Type		
	HPD[m,u] (not for hard usage)	HSJ (hard usage)	HSJW[c,u] (hard usage)
Physical properties:			
Insulation	Table 9	Table 9	Table 9
Jacket	N/A	Table 12	Table 12
Additional tests for cords marked "-W", Clause:	–	–	–
Weather resistance test	N/A	N/A	5.1.17
Insulation resistance	N/A	N/A	5.2.3.1
Permittivity and stability factor	N/A	N/A	5.2.4
Swelling and blistering	N/A	N/A	5.1.11
Additional tests for cords marked "-R", Clause:			
Abrasion test	5.1.14	5.1.14	5.1.14
Mandrel pinching test	5.1.16	5.1.16	5.1.16
Mandrel crushing test	5.1.17	5.1.17	5.1.17
Flexing test	5.1.18	5.1.18	5.1.18

Table 27
Thickness of insulation and web of two-conductor Type HPN and HPNW[c,u]

(See Clause 4.4.3.2, Table 25, and Figure 2.)

Size of conductor, mm² (AWG)				
		0.824 – 1.31 (18 – 16)	1.65, 2.08 (15, 14)	3.31 (12)
Thickness of insulation, mm (mils)	Nominal*	1.14 (45)	1.52 (60)	2.41 (95)
	Minimum at any point before separation	1.02 (40)	1.37 (54)	2.18 (86)
	Minimum at any point after separation	0.69 (27)	0.69 (27)	1.02 (40)
Thickness of web (distance between conductors), mm (mils)	Minimum at any point	2.03 (80)	2.03 (80)	2.79 (110)
* *These values are provided for information only. They are not requirements.*				

Table 28
Thickness of insulation and other dimensions of three-conductor Type HPN and HPNW[c,u]

(See Clause 4.4.3.2, Table 25, and Figure 3.)

		Size of conductor, mm² (AWG)		
		0.824 – 1.31 (18 – 16)	1.65, 2.08 (15, 14)	3.31 (12)
Thickness of insulation, mm (mils)	Nominal*	1.14 (45)	1.52 (60)	2.41 (95)
	Minimum at any point before separation	1.02 (40)	1.37 (54)	2.18 (86)
	Minimum at any point after separation	0.69 (27)	0.69 (27)	1.02 (40)
Minimum distance between conductors, mm (mils)		1.02 (40)	1.02 (40)	1.37 (54)
Minimum average thickness of insulation on grounding conductors, mm (mils)		0.38 (15)	0.38 (15)	0.38 (15)
Minimum thickness at any point, mm (mils)		0.33 (13)	0.33 (13)	0.33 (13)
** These values are provided for information only. They are not requirements.*				

Table 29
Thickness of insulation on Types HSJO, HSJOW, HSJOO, HSJOOW, HSJ, HSJW[c,u], and HPD[m,u]

(See Clause 4.4.3.3 and Table 25 and Table 26.)

Size of conductor, mm² (AWG)	Thickness, mm (mils)	
	Minimum average	Minimum at any point
0.824 – 1.31 (18 – 16)	0.76 (30)	0.69 (27)
1.65 – 3.31 (15 – 12)	1.14 (45)	1.02 (40)

Table 30
Tinsel cords

(See Clauses 4.5, 4.5.3.1, 4.5.3.2, 4.5.3.3, 4.5.5.1, and 4.5.5.2.)

	Type		
	Shaver[u,*]	TPT	TST
Maximum temperatures, °C	60	60	60
Maximum voltage, V	300	300	300
Conductor size, mm² (AWG)	0.100 (27)**	0.100 (27)	0.100 (27)
Number of conductors	2	2	2
Conductor construction, Clause	4.5.2.1.2	4.5.2.1	4.5.2.1
Resistance, Clause	4.5.2.2	4.5.2.2	4.5.2.2
Insulation class	4	4	4
Minimum average thickness, mm (mils)	0.76 (30)	0.76 (30)	0.38 (15)
Minimum thickness at any point, mm (mils)	0.69 (27)	0.69 (27)	0.33 (13)
Thickness of web, minimum at any point, mm (mils)	1.14 (45)	1.14 (45)	N/A

Table 30 Continued on Next Page

Table 30 Continued

	Type		
	Shaver[u, *]	TPT	TST
Assembly of conductors, Clause	4.5.4	4.5.4	4.5.4
Jacket class	N/A	N/A	1.5
Minimum average thickness, mm (mils)	N/A	N/A	0.76 (30)
Minimum thickness, mm (mils)	N/A	N/A	0.61 (24)
Conductor identification, Clause	4.5.7	4.5.7	4.5.7
Tests, Clause:			
Deformation	N/A	N/A	5.1.3.2
Cold bend	5.1.6	5.1.6	5.1.6
Heat-shock resistance	5.1.8	5.1.8	5.1.8
Spark	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7
Copper corrosion	5.2.8	5.2.8	5.2.8
Insulation resistance	5.2.3	5.2.3	5.2.3
Jacket resistance	N/A	N/A	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3
FT1, FT4, VW-1 (Optional)	5.1.5.1, 5.1.5.2, 5.1.5.4	5.1.5.1, 5.1.5.2, 5.1.5.4	5.1.5.1, 5.1.5.2, 5.1.5.4
Physical properties:			
Insulation	Table 9	Table 9	Table 9
Jacket	N/A	N/A	Table 12

** Shaver cord is limited to factory-assembled detachable and nondetachable power supply cords for hand-held 50 W and smaller hair clippers and shaving appliances.*

*** Other gauge sizes may be evaluated in accordance with Clause 4.5.2.1.2.*

Table 31
Elevator travelling cables

(See Clauses 4.6, 4.6.2.1 and 4.6.6.1.)

	Type							
	E	**E**	**EO**	**EO**	**ETT**	**ETT**	**ETP**	**ETP**
Maximum temperature, °C	60	60	60	60	60	60	60	60
Maximum voltage, V	300	600	300	600	300	600	300	600
Size of conductor, mm^2 (AWG)	0.519 – 3.31 (20 – 12)	3.31 – 33.6 (12 – 2)	0.519 – 3.31 (20 – 12)	3.31 – 33.6 (12 – 2)	0.519 – 3.31 (20 – 12)	3.31 – 33.6 (12 – 2)	0.519 – 3.31 (20 – 12)	3.31 – 33.6 (12 – 2)
Conductor:	2 or more							
Material	Soft, annealed copper (Clause 4.1.1.2)							
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)							
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)							
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)							
Insulation class*	1	1	1	1	4	4	4	4
Thickness,	Table 32	Table 32	Table 32	Table 32	Table 32	Table 32	Table 32	Table 32
Braid over insulation, Clause	4.6.3.2	4.6.3.2	4.6.3.2	4.6.3.2	4.6.3.2	4.6.3.2	4.6.3.2	4.6.3.2
Assembly of conductors, Clause	4.6.4	4.6.4	4.6.4	4.6.4	4.6.4	4.6.4	4.6.4	4.6.4
Shielding, Clause	4.6.5	4.6.5	4.6.5	4.6.5	4.6.5	4.6.5	4.6.5	4.6.5
Jacket class	N/A	N/A	1.2	1.2	1.5	1.5	1.5	1.5
Outer braid, Clause	4.6.3.3	4.6.3.3	N/A	N/A	N/A	N/A	N/A	N/A
Thickness, Clause	N/A	N/A	4.6.6.3	4.6.6.3	4.6.6.3	4.6.6.3	4.6.6.3	4.6.6.3
Tests, Clause:								
Flame FT1 (mandatory)	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1	5.1.5.1
Flame VW-1 (optional)	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4	5.1.5.4
Flame FT4 (optional)	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2	5.1.5.2
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Heat-shock resistance	N/A	N/A	N/A	N/A	5.1.8	5.1.8	5.1.8	5.1.8
Spark	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2
Insulation resistance	5.2.3.2	5.2.3.2	5.2.3.2	5.2.3.2	5.2.3.2	5.2.3.2	5.2.3.2	5.2.3.2

Table 31 Continued on Next Page

Table 31 Continued

	Type							
	E	E	EO	EO	ETT	ETT	ETP	ETP
Continuity of conductors	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
Deformation	N/A	N/A	N/A	N/A	5.1.3	5.1.3	5.1.3	5.1.3
Jacket resistance	N/A	N/A	5.2.10	5.2.10	5.2.10	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8
Physical properties:								
Insulation	Table 9	Table 9	Table 9	Table 9	Table 9	Table 9	Table 9	Table 9
Jacket	N/A	N/A	Table 12	Table 12	Table 12	Table 12	Table 12	Table 12

** Class for insulation over circuit conductors only. See Clauses 4.6.4.4.2 and 4.6.4.5(a) for insulation of duplex cables and coaxial cables, respectively.*

Table 32
Insulation thickness of elevator travelling cables

(See Clause 4.6.2.2.)

Conductor size		Average thickness,	Minimum thickness,	Minimum thickness at line of contact,
mm^2	(AWG)	mm (mils)	mm (mils)	mm (mils)
0.519 – 1.31	(20 – 16)	0.51 (20)	0.45 (18)	0.40 (16)
1.65 – 3.31*	(15 – 12*)	0.76 (30)	0.69 (27)	0.61 (24)
3.31 – 5.26	(12 – 10)	1.14 (45)	1.02 (40)	0.91 (36)
8.37 – 32.6	(8 – 2)	1.52 (60)	1.37 (54)	1.22 (48)
** 3.31 mm^2 (12 AWG) rated 300 V only.*				

Table 33
Braid requirements for Type E

(See Clause 4.6.3.3.2.)

Diameter under braid, mm (in)	Minimum thickness of each braid, mm (mils)	Minimum size and ply of yarn, denier/number of ends
0 – 5.08 (0 – 0.20)	0.38 (15)	30/2 or 14/1
5.09 – 8.89 (0.21 – 0.35)	0.43 (17)	26/2 or 12/1
8.90 – 20.3 (0.36 – 0.80)	0.50 (20)	20/2 or 10/1
20.4 – 38.1 (0.81 – 1.50)	0.60 (24)	12/2 or 6/1
38.2 (1.51) and larger	0.78 (31)	3/8

Table 34
Lay of conductors of Types E, EO, ETT, and conductor groups of Type ETP

(See Clauses 4.6.4.1 and 4.6.4.4.3.)

Number of conductors	Maximum length of lay
2	30 times conductor diameter
3	35 times conductor diameter
4	40 times conductor diameter
5 or more	15 times the overall diameter of the assembly, except that in a multiple layer cable the length of the lay of the conductors in the inner layers shall be not more than 20 times the overall diameter of that layer
Note: *"Conductor diameter" means the diameter of the individual, finished, insulated conductors of which the cord or cable is composed.*	

Table 35
Thickness of jacket on Type EO

(See Clause 4.6.6.2.)

Core diameter, mm (in)	Thickness, mm (mils)	
	Minimum average	Minimum at any point
0 – 12.7 (0 – 0.50)	2.03 (80)	1.62 (64)
12.8 – 19.1 (0.51 – 0.75)	2.41 (95)	1.93 (76)
19.2 – 25.4 (0.76 – 1.00)	2.79 (110)	2.23 (88)
25.5 – 38.1 (1.01 – 1.50)	3.17 (125)	2.54 (100)
38.2 – 50.8 (1.51 – 2.00)	3.56 (140)	2.84 (112)

Table 36
Thickness of jacket on Types ETT and ETP and minimum thickness of mandatory web(s) on Type ETP

(See Clause 4.6.6.2.)

Core diameter, mm (in)	Thickness, mm (mils)	
	Minimum average	Minimum at any point of jacket and web(s)
0 – 6.3 (0 – 0.25)	0.89 (35)	0.71 (28)
6.4 – 12.7 (0.26 – 0.50)	1.14 (45)	0.91 (36)
12.8 – 25.4 (0.51 – 1.00)	1.52 (60)	1.21 (48)
25.5 (1.01) and larger	2.03 (80)	1.62 (64)

Notes:

(1) *The core diameter shall be measured over the fibrous covering enclosing the conductor assembly for Type ETT.*

(2) *For Type ETP, the core diameter for group constructions shall be determined by measuring the diameter of the largest group, including the fibrous covering if present. For nongroup constructions, the core diameter shall be determined by measuring the diameter of the largest conductor in the cable.*

(3) *Web thickness is the distance (jacket thickness) between conductors, support members, or groups.*

Table 37
Hoistway cables

(See Clauses 4.7, 4.7.4.2, and 4.7.5.6.)

	Type			
	Hoistway cables			
Maximum temperature, °C	60	60	90	90
Maximum voltage, V	300	600	300	600
Size of conductor, mm^2 (AWG)	0.519 – 3.31 (20 – 12)	0.824 – 3.31 (18 – 12)	0.519 – 3.31 (20 – 12)	0.824 – 3.31 (18 – 12)
Conductor:	2 or more			
Material	Soft, annealed copper (Clause 4.1.1.2)			
Size	Cross-sectional area and DC resistance (Clause 4.1.1.3.1)			
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)			
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)			
Insulation class	4	4	17	17
Thickness,	Table 38	Table 38	Table 38	Table 38
Assembly of conductors, Clause	4.7.5	4.7.5	4.7.5	4.7.5
Jacket class (optional)	1.5	1.5	1.7	1.7
Thickness,	Table 39	Table 39	Table 39	Table 39
Test, Clause:				
Deformation, insulation, and jacket	5.1.3	5.1.3	5.1.3	5.1.3
Flame FT1 (mandatory)	5.3.1	5.3.1	5.3.1	5.3.1
Flame FT4, VW-1 (optional)	5.1.5.2, 5.1.5.4	5.1.5.2, 5.1.5.4	5.1.5.2, 5.1.5.4	5.1.5.2, 5.1.5.4
Cold bend	5.3.3	5.3.3	5.3.3	5.3.3
Heat-shock resistance	5.3.2	5.3.2	5.3.2	5.3.2
Spark	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.3.4 and 5.2.2	5.3.4 and 5.2.2	5.3.4 and 5.2.2	5.3.4 and 5.2.2
Insulation resistance	5.2.3.2	5.2.3.2	5.2.3.2	5.2.3.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8
Jacket resistance	5.2.10	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12
Physical properties:				
Insulation	Table 9	Table 9	Table 9	Table 9
Jacket (where applicable)	Table 12	Table 12	Table 12	Table 12

Table 38
Insulation thicknesses for hoistway cables

(See Clauses 4.7.4.3 and 4.7.4.4.)

Size, mm^2 (AWG)	600 V cables, mm (mils)		300 V cables, mm (mils)	
	Minimum average	Minimum at any point	Minimum average	Minimum at any point
0.519 (20)	–	–	0.50 (20)	0.45 (18)
0.824 (18)	0.76 (30)	0.69 (27)	0.50 (20)	0.45 (18)
1.31 (16)	0.76 (30)	0.69 (27)	0.50 (20)	0.45 (18)
2.08 (14)	0.76 (30)	0.69 (27)	0.76 (30)	0.69 (27)
3.31 (12)	0.76 (30)	0.69 (27)	0.76 (30)	0.69 (27)

Notes:

(1) *For 300 V constructions in sizes 0.519 mm^2 (20 AWG), 0.824 mm^2 (18 AWG), and 1.31 mm^2 (16 AWG), an alternative insulation thickness of 0.38 mm (15 mils) minimum average (0.33 mm (13 mils) minimum) for PVC plus 0.10 mm (4 mils) minimum at any point of nylon covering shall be permitted.*

(2) *A thickness of 80 percent of the minimum average shall be permitted only at the line of contact between conductors.*

Table 39
Jacket thickness for hoistway cables

(See Clause 4.7.5.6.)

Core diameter, mm (in)	Jacket thickness, mm (mils)	
	Minimum average	Minimum at any point
0 – 5.7 (0 – 0.40)	0.50 (20)	0.40 (16)
5.8 – 17.7 (0.41 – 0.70)	0.76 (30)	0.61 (24)
17.8 – 25.4 (0.71 – 1.00)	0.88 (35)	0.70 (28)
25.5 – 38.1 (1.01 – 1.50)	1.02 (40)	0.81 (32)
38.2 (1.51) and larger	1.14 (45)	0.91 (36)

Table 40
Electric vehicle cable

(See Clauses 4.8, 4.8.3.1, 4.8.7.1, and 5.1.3.2.)

	Type					
	Hard usage			Extra hard usage		
	EVJ	EVJE	EVJT	EV	EVE	EVT
Temperature ratings, °C	60, 75, 90, 105	90, 105	60, 75, 90, 105	60, 75, 90, 105	90, 105	60, 75, 90, 105
Maximum voltage, V	300			600 or 1000		
Size of conductors, mm^2 (AWG)	0.824 – 3.31 (18 – 12)			0.824 – 253 (18 AWG – 500 kcmil)		
Number of circuit conductors	2 – 6			2 or more		
Data, signal and communications cables	Optional, any conductor sizes indicated in Table 1					

Table 40 Continued on Next Page

Table 40 Continued

	Type					
	Hard usage			Extra hard usage		
	EVJ	EVJE	EVJT	EV	EVE	EVT
Optical fibre members	Optional (Clause 4.1.12)					
Covering	4.8.4	4.8.4	4.8.4	4.8.4	4.8.4	4.8.4
Grounding conductor, Clause	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8	4.1.1.8
Circuit conductor:						
Material	Soft, annealed copper (Clause 4.1.1.2)					
Size	Cross-sectional area/DC resistance (Clause 4.1.1.3.1)					
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)					
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)					
Data/signal/communications conductor:						
Material	Soft, annealed copper (Clause 4.1.1.2)					
Size	Diameter or cross-sectional area (Clause 4.1.1.3.1)					
Stranding	Size of wires (Clause 4.1.1.7.1), lay of wires (Clause 4.1.1.7.2)					
General	Joints, coatings, separators (Clauses 4.1.1.4, 4.1.1.5, and 4.1.1.6)					
Insulation class, Clause	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2	4.1.2
Circuit and signal conductors						
60°C	1, 13	N/A	4	1, 13	N/A	4
75°C	2	N/A	5	2	N/A	5
90°C	3, 12	15	6	3, 12	15	6
105°C	18, 19	16	7	18, 19	16	7
Grounding conductor						
60°C	1, 13	N/A	4	1, 13	N/A	4
75°C	2	N/A	5	2	N/A	5
90°C	3, 12	15	6	3, 12	15	6
105°C	18, 19	16	7	18, 19	16	7
Insulation thickness when covering is not employed:						
Minimum average thickness, mm (mils)	0.76 (30)			0.325 – 1.65 mm^2 (22 – 15 AWG) 0.76 (30)		
				2.08 – 6.63 mm^2 (14 – 9 AWG) 1.14 (45)		
				8.37 – 33.6 mm^2 (8 – 2 AWG) 1.52 (60)		
				42.4 – 107.2 mm^2 (1 – 4/0 AWG) 2.03 (80)		
				127 – 253 mm^2 (250 – 500 kcmil) 2.41 (95)		
Minimum thickness at any point, mm (mils)	0.68 (27)			90 percent of the minimum average thickness		
Minimum thickness at point of contact, mm (mils)	0.61 (24)			80 percent of the minimum average thickness		
Insulation thickness when covering is employed:						
Minimum average thickness, mm (mils)	0.51 (20)			0.325 – 1.65 mm^2 (22 – 15 AWG) 0.51 (20)		
				2.08 – 6.63 mm^2 (14 – 9 AWG) 0.76 (30)		

Table 40 Continued on Next Page

Table 40 Continued

	Type					
	Hard usage			Extra hard usage		
	EVJ	EVJE	EVJT	EV	EVE	EVT
				8.37 – 33.6 mm^2 (8 – 2 AWG) 1.14 (45)		
				42.4 – 107.2 mm^2 (1 – 4/0 AWG) 1.52 (60)		
				127 – 253 mm^2 (250 – 500 kcmil) 1.90 (75)		
Minimum thickness at any point, mm (mils)	0.45 (18)			90 percent of the minimum average thickness		
Minimum thickness at point of contact of insulation, mm (mils)	0.40 (16)			80 percent of the minimum average thickness		
Minimum nylon thickness, mm (mils) over insulation	0.10 (4)			0.325 – 1.65 mm^2 (22 – 15 AWG) 0.10 (4)		
				2.08 – 6.63 mm^2 (14 – 9 AWG) 0.13 (5)		
				8.37 – 33.6 mm^2 (8 – 2 AWG) 0.15 (6)		
				42.4 – 107.2 mm^2 (1 – 4/0 AWG) 0.18 (7)		
				127 – 253 mm^2 (250 – 500 kcmil) 0.20 (8)		
Assembly, Clause	4.1.4	4.1.4	4.1.4	4.1.4	4.1.4	4.1.4
Optional shielding, Clause	4.1.5	4.1.5	4.1.5	4.1.5	4.1.5	4.1.5
Jacket class						
60°C	1.2	N/A	1.5	1.2	N/A	1.5
75°C	1.3	N/A	1.6	1.3	N/A	1.6
90°C	1.4	1.10	1.7	1.4	1.10	1.7
105°C	1.12	1.11	1.8	1.12	1.11	1.8
Minimum and average thickness of jacket,	Table 54, Table 55			Table 57, Table 58		
General, Clause	4.1.6	4.1.6	4.1.6	4.1.6	4.1.6	4.1.6
Overall diameter, Clause	4.8.8	4.8.8	4.8.8	4.8.8	4.8.8	4.8.8
Conductor identification, Clause	4.1.9	4.1.9	4.1.9	4.1.9	4.1.9	4.1.9
Tests, Clause						
Cold bend	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6	5.1.6
Heat-shock resistance	N/A	5.1.8	5.1.8	N/A	5.1.8	5.1.8
Spark	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1	5.2.1
Dielectric strength	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2	5.2.2
Continuity	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7	5.2.7
Mechanical strength	5.1.4	5.1.4	5.1.4	5.1.4	5.1.4	5.1.4
Flexing of shielded cords	5.2.9	5.2.9	5.2.9	5.2.9	5.2.9	5.2.9
Jacket resistance	5.2.10	5.2.10	5.2.10	5.2.10	5.2.10	5.2.10
Durability of printing	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12	5.1.12
Copper corrosion	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8	5.2.8
Bend test on nylon-covered conductors	5.1.9	5.1.9	5.1.9	5.1.9	5.1.9	5.1.9
Deformation	N/A	5.1.3	5.1.3	N/A	5.1.3	5.1.3

Table 40 Continued on Next Page

Table 40 Continued

	Type					
	Hard usage			Extra hard usage		
	EVJ	EVJE	EVJT	EV	EVE	EVT
Low temperature impact (Sizes 10 AWG and larger)	N/A	N/A	N/A	5.1.22	5.1.22	5.1.22
Crush resistance	5.1.23	5.1.23	5.1.23	5.1.23	5.1.23	5.1.23
Flame (FT2)	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3	5.1.5.3
(Optional) FT1, FT4, VW-1	5.1.5	5.1.5	5.1.5	5.1.5	5.1.5	5.1.5
Weather resistance	5.1.7	5.1.7	5.1.7	5.1.7	5.1.7	5.1.7
Insulation resistance	5.2.3.1	5.2.3.1	5.2.3.1	5.2.3.1	5.2.3.1	5.2.3.1
Permittivity and stability factor	5.2.4	5.2.4	5.2.4	5.2.4	5.2.4	5.2.4
Swelling and blistering	5.1.11	N/A	N/A	5.1.11	N/A	N/A
Physical properties,						
Insulation	Table 9	Table 9	Table 9	Table 9	Table 9	Table 9
Jacket	Table 12	Table 12	Table 12	Table 12	Table 12	Table 12

Table 41
Deformation test

(See Clauses 5.1.3.1.)

Size of conductor, mm^2 (AWG)	Mass on insulation specimen, g		
0.162 – 0.325 (25 – 22)	200		
0.519, 0.824, 1.04 (20, 18, 17)	300		
1.31 (16)	400		
1.65 – 42.4 (15 – 1)	500		
53.5 – 107.2 (1/0 – 4/0)	1000		
127 – 253 (250 – 500 kcmil)	2000		
	Test temperature, °C		
Insulation class:	100 ±2	121 ±2	150 ±2
4, 5, 6, 7, 10, 11, 17		X	
14, 15, 16			X
8, 9	X		
Jacket class:			
1.5, 1.6, 1.7, 1.8		X	
1.9, 1.10, 1.11			X

Table 42
Temperature for cold bend test

(See Clause 5.1.6.)

Type of cord	Test temperature
Any "W" cord or "electric vehicle cable" not marked or marked –40°C	–40°C
Any "W" cord or "electric vehicle cable" marked –50°C	–50°C
Any "W" cord or "electric vehicle cable" marked –60°C	–60°C
Any "W" cord or "electric vehicle cable" marked –70°C	–70°C
Any other type of cord	–20°C

Table 43
Mandrel diameter for cold bend test

(See Clauses 5.1.6 and 5.1.7.)

Minor diameter of flat cord or overall diameter of round finished cord, mm (in)	Diameter of mandrel, mm (in)	Number of turns around mandrel (see Note 1)
0 – 3.18 (0 – 0.125)	6.5 (0.25)	6
3.19 – 6.35 (0.126 – 0.250)	12.7 (0.50)	6
6.36 – 9.52 (0.251 – 0.375)	19.0 (0.75)	6
9.53 – 12.70 (0.376 – 0.500)	25.4 (1.00)	6
12.71 – 15.88 (0.501 – 0.625)	31.8 (1.25)	6
15.89 – 19.05 (0.626 – 0.750)	38.0 (1.50)	1
19.06 – 22.22 (0.751 – 0.874)	44.5 (1.75)	1
22.23 – 25.40 (0.875 – 1.00)	50.8 (2.00)	1
25.41 – 28.58 (1.01 – 1.13)	57.1 (2.25)	1
28.59 – 31.75 (1.14 – 1.25)	63.5 (2.50)	1
31.76 – 34.92 (1.26 – 1.38)	69.9 (2.75)	1
34.93 – 38.10 (1.39 – 1.50)	76.2 (3.00)	1
38.11 – 41.28 (1.51 – 1.63)	82.6 (3.25)	1
41.29 – 44.45 (1.64 – 1.75)	88.9 (3.50)	1
44.46 – 47.62 (1.76 – 1.88)	95.2 (3.75)	1
47.63 – 50.8 (1.89 – 2.00)	101.6 (4.00)	1
Larger than 50.8 (2.00)	2 X cable diameter	1

Note:

(1) *The specimen shall be wound six close turns around the mandrel.*

Table 44
Mandrel diameter for heat-shock resistance test on thermoplastic insulation, mm (in)

(See Clause 5.1.8.1.)

Size of conductor mm^2 (AWG)	Types PXT[c], TX[c], ETT, ETP, SPT-1, SPE-1, SPT-1W[c,u], SPT-0[m], clock cord[u], and individual conduct or of jacketed cords and cables	Type TPT	Shaver cord[u]	Individual conductor of Type TST	Type XTW[u], CXTW[u], LXT[u], LXTW[u]	Type CXWT[c]	Type YXWT[u]	Types SPT-2, SPT-2W[c,u], SPE-2, PXWT[c], DPTW[c,u], DPT[c,u]	Types SPT-3, SPE-3
0.100 (27)	–	2.4 (0.094)	2.4 (0.094)	2.4 (0.094)	–	–	–	–	–
0.162 (25)	–	–	–	–	2.4 (0.094)	–	–	–	–
0.205 ((24)	–	–	–	–	2.4 (0.094)	–	–	–	–
0.259 (23)	–	–	–	–	2.4 (0.094)	–	–	–	–
0.325 (22)	2.0 (0.078)	–	2.4 (0.094)	–	2.4 (0.094)	3.6 (0.14)	–	4.0 (0.16)	–
0.519 (20)	2.4 (0.094)	–	2.4 (0.094)	–	2.4 (0.094)	3.6 (0.14)	4.0 (0.16)	4.0 (0.16)	–
0.824 (18)	2.8 (0.11)	–	–	–	2.4 (0.094)	3.6 (0.14)	4.0 (0.16)	4.0 (0.16)	5.2 (0.20)
1.04 (17)	3.0 (0.12)	–	–	–	–	–	–	4.6 (0.18)	5.4 (0.21)
1.31 (16)	3.3 (0.13)	–	–	–	–	4.0 (0.16)	–	5.2 (0.20)	5.6 (0.22)
1.65 (15)	3.6 (0.14)	–	–	–	–	–	–	–	5.8 (0.23)
2.08 (14)	4.0 (0.16)	–	–	–	–	6.7 (0.27)	–	5.6 (0.22)	6.0 (0.24)
2.63 (13)	4.4 (0.17)	–	–	–	–	–	–	–	–
3.31 (12)	4.8 (0.19)	–	–	–	–	6.7 (0.27)	–	–	7.1 (0.28)
4.17 (11)	5.2 (0.20)	–	–	–	–	–	–	–	–
5.26 (10)	5.6 (0.22)	–	–	–	–	–	–	–	7.9 (0.31)
6.63 (9)	6.1 (0.24)	–	–	–	–	–	–	–	–
8.37 (8)	6.7 (0.27)	–	–	–	–	–	–	–	–
10.6 (7)	7.3 (0.29)	–	–	–	–	–	–	–	–
13.3 (6)	7.9 (0.31)	–	–	–	–	–	–	–	–
16.8 (5)	8.5 (0.33)	–	–	–	–	–	–	–	–
21.2 (4)	9.1 (0.36)	–	–	–	–	–	–	–	–

Table 44 Continued on Next Page

Table 44 Continued

Size of conductor mm^2 (AWG)	Types PXT[c], TX[c], ETT, ETP, SPT-1, SPE-1, SPT-1W[c,u], SPT-0[m], clock cord[u], and individual conduct or of jacketed cords and cables	Type TPT	Shaver cord[u]	Individual conductor of Type TST	Type XTW[u], CXTW[u], LXT[u], LXTW[u]	Type CXWT[c]	Type YXWT[u]	Types SPT-2, SPT-2W[c,u], SPE-2, PXWT[c], DPTW[c,u], DPT[c,u]	Types SPT-3, SPE-3
26.7 (3)	10.0 (0.39)	–	–	–	–	–	–	–	–
33.6 (2)	11.0 (0.44)	–	–	–	–	–	–	–	–
42.4 (1)	12 (0.48)								
53.5 (1/0)	13 (0.53)								
67.4 (2/0)	15 (0.59)								
85.0 (3/0)	16.5 (0.65)								
107.2 (4/0)	18 (0.71)								
127 – 253 (250 – 500 kcmil)	1.5 times insulated conductor diameter								

Table 45
Mandrel diameter for heat-shock resistance test on jackets

(See Clause 5.1.8.2.)

Overall diameter of finished cord or minor dimension of flat cords, mm (in)	Diameter of mandrel, mm (in)
0.0 – 6.35 (0 – 0.250)	12.7 (0.50)
6.36 – 7.92 (0.251 – 0.312)	20.6 (0.81)
7.93 – 9.52 (0.313 – 0.375)	28.6 (1.13)
9.53 – 11.1 (0.376 – 0.437)	34.9 (1.37)
11.2 – 12.7 (0.438 – 0.500)	42.8 (1.69)
12.8 – 14.3 (0.501 – 0.563)	50.8 (2.00)
14.4 – 15.9 (0.564 – 0.625)	54.0 (2.13)
16.0 – 17.4 (0.626 – 0.685)	65.1 (2.56)
17.5 – 19.0 (0.686 – 0.750)	73.0 (2.87)
19.1 – 21.6 (0.751 – 0.850)	79.4 (3.13)
21.7 – 25.4 (0.851 – 1.00)	82.6 (3.25)
25.5 – 28.6 (1.01 – 1.13)	88.9 (3.50)
28.7 – 31.7 (1.14 – 1.25)	95.3 (3.75)
31.8 – 34.9 (1.26 – 1.37)	108 (4.25)
35.0 – 38.1 (1.38 – 1.50)	114 (4.30)
38.2 – 41.3 (1.51 – 1.63)	127 (5.00)
41.4 – 44.4 (1.64 – 1.75)	133 (5.25)
44.5 – 47.6 (1.76 – 1.87)	143 (5.63)
47.7 – 50.8 (1.88 – 2.00)	152 (6.00)
Larger than 50.8 (2.00)	3 X cable diameter

Notes:

(1) *For round cable having an overall diameter less than 19 mm (0.748 in), the specimen shall be wound six close turns around the mandrel. For round cable having a diameter of 19 mm (0.748 in) or greater, the specimen shall be wound one complete turn around the mandrel.*

(2) *For flat cables having a major dimension less than 25 mm (1 in), the specimen shall be wound six turns around the mandrel. For flat cables having a major dimension of 25 mm (1 in) or greater, the specimen shall be wound one turn around the mandrel.*

Table 46
Spark test voltage

(See Clause 5.2.1.)

Type of cord or cable	Conductor size, mm^2 (AWG)	Average insulation thickness, mm (mils)	AC spark test potential, kV*
SV, SVO, SVOO, SVE, SVEO, SVEOO, SVT, SVTO, SVTOO	0.824, 1.04, 1.31 (18, 17, 16)	0.38 (15)	3
TST	0.100 (27)	0.38 (15)	3
SJ, SJT, SJTO, SJTOO, SJE, SJEO, SJEOO, SJO, SJOO, SJOW, SJOOW, SJTW,	0.325 – 4.17 (22 – 11)	0.76 (30)	6
	5.26 (10)	1.14 (45)	7.5

Table 46 Continued on Next Page