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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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.