

UL 444

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Communications Cables

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UL Standard for Safety for Communications Cables, UL 444

Third Edition, Dated March 29, 2002

Revisions: This Standard contains revisions through and including September 29, 2006.

SUMMARY OF TOPICS

The revisions dated September 29, 2006 were issued to incorporate the following:

- ***Revisions to Clause 6.13, Cold Impact of Outdoor Type CMX Cable, to address more current and common test methodology.***
- ***Addition of new Clauses 6.22 and 7.3.8 indicating marking and test requirements for communication wires and cables located outdoors, and exposed to direct sunlight.***

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Text that has been changed in any manner is marked with a vertical line in the margin.

The new and revised requirements are substantially in accordance with UL's Proposal(s) on this subject dated July 14, 2006.

The revisions dated September 29, 2006 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page 1), this UL Standard for Safety is an American National Standard. Attention is directed to the note on the title page of this Standard outlining the procedures to be followed to retain the approved text of this ANSI/UL Standard.

The UL Foreword is no longer located within the UL Standard. For information concerning the use and application of the requirements contained in this Standard, the current version of the UL Foreword is located on ULStandardsInfoNet at: <http://ulstandardsinfo.net/ulforeword.html>

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The requirements in this Standard are now in effect, except for those paragraphs, sections, tables, figures, and/or other elements of the Standard having future effective dates as indicated in the preface. The prior text for requirements that have been revised and that have a future effective date are located after the Standard, and are preceded by a

New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

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This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-6	September 29, 2006
7	March 1, 2005
8	September 29, 2006
9-12B	March 1, 2005
13-15	March 29, 2002
16-17	March 1, 2005
18-27	March 29, 2002
28-29	September 29, 2006
30-32	March 29, 2002
33-34B	September 29, 2006
35	March 1, 2005
36	September 29, 2006
37-44	March 1, 2005
45	September 29, 2006
46	March 1, 2005
47-48	September 29, 2006
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Approved
by
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ANSI/UL 444-2006

Commitment for Amendments

This Standard is issued jointly by Canadian Standards Association (CSA) and Underwriters Laboratories Incorporated (UL). Amendments to this Standard will be made only after processing according to the Standards writing procedures by CSA and UL.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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CONTENTS

Preface	5
Foreword (CSA)	7
Communication Cables	
1 Scope	9
2 Definitions	9
3 General	10
3.1 Reference publications	10
3.2 Units of measurement	12
3.3 General requirements	12
4 Construction	12
4.1 Conductors	12
4.2 Insulation	13
4.3 Optical fibre members	14
4.4 Core assembly	14
4.5 Spare pairs	15
4.6 Core binders	15
4.7 Core wrap	15
4.8 Shields	15
4.9 Jackets	16
4.10 Metallic sheaths	17
5 Manufacturing and production tests	17
5.1 Spark test after insulating	17
5.2 Continuity	19
5.3 Dielectric strength	19
6 Capability tests	20
6.1 Corrosion resistance of uncoated copper conductors	20
6.2 Crush resistance of insulation	21
6.3 Insulation unaged and heat-aged requirements	22
6.4 Insulation shrinkback	23
6.5 Insulation cold bend	23
6.6 AC leakage current through overall jacket	23
6.7 Durability of printing	24
6.8 Unaged and heat-aged requirements of jacket	24
6.9 Flexibility (PVDF jackets rated 125°C only)	25
6.10 Cable cold bend	26
6.11 Jacket peel test	26
6.12 Sunlight resistance of jacket of outdoor Type CMX cable	27
6.13 Cold impact of outdoor Type CMX cable	28
6.14 Flame and smoke requirements	29
6.15 Measuring thickness of insulation and rounding off the results	30
6.16 Conductor resistance	31
6.17 Conductor diameter	31
6.18 Compressive loading test for Type CMUC	32
6.19 Heat shock test for cross-connect wire	32
6.20 Deformation test for cross-connect wire	33
6.21 Dielectric tests for cross-connect wire	33
6.22 Sunlight resistant test	34

7 Marking of Cables	34
7.1 General	34
7.2 Type of marking	34
7.3 Required marking	34A
7.4 Optional marking	36
7.5 Intervals	37
8 Marking on tag, reel, or carton	37
8.1 General requirements	37
8.2 Other marking	38
9 Date of manufacture	38

TABLES

Appendix A

Guidelines for sample selection for flame and smoke test requirements

Appendix B

Cable substitutions

Preface

This is the common UL and CSA Standard for Communications Cables. It is the sixth edition of CSA C22.2 No. 214 and the third edition of UL 444. This common standard has been jointly revised on September 29, 2006. For this purpose, CSA and UL are issuing revision pages dated September 29, 2006.

This common standard was prepared by Canadian Standards Association and Underwriters Laboratories Inc. The effort of UL 444/CSA 214 Harmonization Committee is greatly appreciated.

This standard was reviewed by the CSA Subcommittee on C22.2 No. 214, under the jurisdiction of the Technical Committee on Wiring Products and the Strategic Resource Group, and has been formally approved by the Technical Committee.

This standard has been approved as a National Standard of Canada by the Standards Council of Canada.

This standard has been approved by the American National Standards Institute (ANSI) as an American National Standard.

The most recent designation of ANSI/UL 444-2006 as an American National Standard occurred on September 29, 2006.

This ANSI/UL Standard for Safety, which consists of the third edition (with revisions through September 29, 2006), is under continuous maintenance, whereby each revision is ANSI approved upon publication. 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 <http://csds.ul.com>.

A UL standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements.

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

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

Level of harmonization

This standard uses an IEC format, but is not based on, nor shall it be considered equivalent to, an IEC standard. This standard is published as an identical standard. An identical standard is a standard that is the same in technical content except for conflicts in Codes and Governmental Regulations. Presentation shall be word for word except for editorial changes.

Interpretations

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

CSA Effective Date

The effective date for CSA will be announced through CSA *Informs* or a CSA Certification Notice.

UL Effective Date

As of September 29, 2006 all products Listed or Recognized by UL must comply with the requirements in this standard.

A UL effective date is one established by Underwriters Laboratories Inc. and is not part of the ANSI approved standard.

The most recent designation of UL 444 as an American National Standard (ANSI) occurred on September 29, 2006.

This ANSI/UL Standard for Safety, which consists of the Third Edition with revisions through September 29, 2006 is under continuous maintenance, whereby each revision is ANSI approved upon publication.

Foreword (CSA)

The Canadian Standards Association (CSA) develops standards under the name Canadian Standards Association, and provides certification and testing under the name CSA International. CSA International provides certification services for manufacturers who, under license from CSA, wish to use the appropriate registered CSA Marks on certain products of their manufacture to indicate conformity with CSA Standards.

CSA Certification for a number of products is provided in the interest of maintaining agreed-upon standards of quality, performance, interchangeability and/or safety, as appropriate. Where applicable, certification may form the basis for acceptance by inspection authorities responsible for enforcement of regulations. Where feasible, programs will be developed for additional products for which certification is desired by producers, consumers, or other interests. In performing its functions in accordance with its objectives, CSA does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of the Association represent its professional judgement given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed.

Products in substantial accord with this Standard but which exhibit a minor difference or a new feature may be deemed to meet the Standard providing the feature or difference is found acceptable utilizing appropriate CSA International Operating Procedures. Products that comply with this Standard shall not be certified if they are found to have additional features which are inconsistent with the intent of this Standard. Products shall not be certifiable if they are discovered to contravene applicable laws or regulations.

Testing techniques, test procedures, and instrumentation frequently must be prescribed by CSA International in addition to the technical requirements contained in Standards of CSA. In addition to markings specified in the Standard, CSA International may require special cautions, markings, and instructions that are not specified by the Standard.

Some tests required by CSA Standards may be inherently hazardous. The Association neither assumes nor accepts any responsibility for any injury or damage that may occur during or as the result of tests, wherever performed, whether performed in whole or in part by the manufacturer or the Association, and whether or not any equipment, facility, or personnel for or in connection with the test is furnished by the manufacturer or the Association.

Manufacturers should note that, in the event of the failure of CSA International to resolve an issue arising from the interpretation of requirements, there is an appeal procedure: the complainant should submit the matter, in writing, to the Secretary of the Canadian Standards Association.

If this Standard is to be used in obtaining CSA Certification please remember, when making application for certification, to request all current Amendments, Bulletins, Notices, and Technical Information Letters that may be applicable and for which there may be a nominal charge. For such information or for further information concerning CSA Certification, please address your inquiry to Applications and Customer Service, CSA International, 178 Rexdale Boulevard, Toronto, Ontario, Canada M9W 1R3.

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Communication Cables

1 Scope

1.1 This standard applies to 60 – 250°C single- or multiple-conductor jacketed or unjacketed, integral or nonintegral cables and single or multiple coaxial cables for telephone and other communication circuits such as voice, data, and audio for on-premise customer systems. These cables are not prohibited from containing one or more optical fibre members. For the purpose of this standard, a coaxial cable or coaxial member conductor is a single conductor with a shield. For the purpose of this standard, a single- or multiple-conductor unjacketed cable is a cross-connect wire.

1.2 This standard applies to communications cables that are intended primarily for installation in accordance with Section 60 of the *Canadian Electrical Code*(CEC), *Part I*, and Article 800 of the *National Electrical Code*(NEC). They are rated for 300 V applications but are not so marked.

1.3 This standard does not apply to communication cords.

1.4 In Canada, Type CMUC and cross-connect communications cables are not recognized by the Canadian Electrical Code, Part I.

2 Definitions

2.1 The following definitions apply in this standard:

2.2 **BONDED METAL SHIELD** – A covering over the cable core assembly consisting of a metal tape whose outer surface is adhesively bound to a polymeric jacket over it.

2.3 **CAPABILITY TEST** – A test that is conducted periodically on a cable component, or on a completed cable, intended to be proof of adequate construction and processing, and that is repeated for verification.

2.4 **COAXIAL CABLE** – A cable having one or more coaxial members, each consisting of a conductor centered inside one or more outer conductors consisting of metal tubes or shields, separated from the central conductor by a dielectric material.

2.5 **COVERING** – A jacket, sheath, or armour.

2.6 **CROSS-CONNECT WIRE (CABLE)** – A single- or multiple-conductor construction consisting of insulated conductors without an overall jacket.

2.7 **DIELECTRIC** – An insulating (nonconducting) medium.

2.8 **EQUIVALENT GAUGE** – A round conductor AWG number used to designate a flat conductor that has a cross-sectional area equal to that of the round conductor.

2.9 **GROUND PLANE** – A partially encompassing shield provided to reduce stray electrical fields.

2.10 **INTEGRAL** – A single extruded layer that serves as both insulation and jacket.

2.11 **JACKET** – A continuous nonmetallic outer covering.

2.12 **MANUFACTURING AND PRODUCTION TEST** – A test performed on a length of wire before further processing and/or on a completed cable before shipment.

Note: Where in-line packaging is used, and where conformity of the packaged product can be demonstrated, the tests may be performed on a master reel of the assembled cable prior to application of the final jacket.

2.13 SEMICONDUCTING – A material whose resistivity at room temperature is in the range of 10^{-2} – $10^9 \Omega \cdot \text{cm}$.

2.14 SHIELD – A conducting layer consisting of tape, braid, wire, or sheath, or a semiconducting layer.

2.15 THERMOPLASTIC – An insulation or jacket material that is capable of being repeatedly softened by heating and hardened by cooling through a temperature range characteristic of the material, and which in its softened state is capable of being shaped through the application of force.

Note: Examples of thermoplastic materials are polyethylene (PE), poly (vinyl chloride) (PVC), nylon, and polyethylene terephthalate (PET).

2.16 THERMOSET – A cross-linked insulating or jacketing compound that does not soften and flow on subsequent heating.

3 General

3.1 Reference publications

Where reference is made to other publications, such reference shall be considered to refer to the latest edition and all amendments published to that edition up to the time when the referencing standard is approved.

CSA Standards

C22.1-2002,
Canadian Electrical Code, Part I;

CAN/CSA-C22.2 No. 0-M91 (R1997),
General Requirements – Canadian Electrical Code, Part II;

C22.2 No. 0.3-01,
Test Methods for Electrical Wires and Cables

UL Standards

UL 1581-2001,
Reference Standard for Electrical Wires, Cables, and Flexible Cords;

UL 1666-2000,
Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts;

UL 1685-1997,
Vertical-Tray Fire-Propagation and Smoke-Release Test for Electrical and Optical-Fiber Cables.

ANSI¹Standard

Z136 Series-1996/2000,
Safe Use of Lasers.

ANSI/NFPA² Standard

70-2002,
National Electric Code.

ASTM³ Standards

B 33-00,
Specification for Tinned Soft or Annealed Copper Wire for Electrical Purposes;

B 189-95,
Specification for Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes;

B 286-95,
Specification for Copper Conductors for Use in Hookup Wire for Electronic Equipment;

B 298-99,
Specification for Silver-Coated Soft or Annealed Copper Wire;

B 355-95,
Specification for Nickel-Coated Soft or Annealed Copper Wire;

B 452-98,
Specification for Copper-Clad Steel Wire for Electronic Application;

B 869-96,
Specification for Copper-clad Steel Electrical Conductor for CATV Drop Wire;

D 573-99 ,
Standard Test Method for Rubber-Deterioration in an Air Oven;

D 5374-99,
Test Methods for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation;

D 5423-99,
Specification for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation;

G 151-00,
Standard Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources;

G 153-00,
Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials.

NFPA⁴ Standard

NFPA 262-1999
Standard Method of Test for Fire and Smoke Characteristics of Wire and Cables.

¹ American National Standards Institute

² American National Standards Institute/National Fire Protection Association.

³ American Society for Testing and Materials.

⁴ National Fire Protection Association.

3.2 Units of measurement

If a value for measurement is followed by a value in other units in parenthesis, the second value may be only approximate. The first stated value is the requirement.

3.3 General requirements

The requirements of CAN/CSA-C22.2 No. 0, when appropriate, apply to this standard.

4 Construction

4.1 Conductors

4.1.1 The conductors shall be solid or stranded, annealed, bare or metal-coated copper. The centre conductor of CMP, CMR, CMG, CM, CMH and CMX coaxial cables made of copper-clad steel shall have 21 percent or higher conductivity in accordance with ASTM Standard B 869. If the insulation adjacent to the copper conductor is of a material that corrodes unprotected copper in the test described in Clause 6.1, the conductor shall be covered with a coating of tin complying with ASTM Standard B 33, of lead or lead-alloy complying with ASTM Standard B 189, of nickel complying with ASTM Standard B 355, of silver complying with ASTM Standard B 298, or of another metal or alloy (evaluation shall be required). Metal-coating a conductor on which the coating is not required for corrosion protection shall be permitted. When this is done, the 100 per cent coverage requirement of the relevant ASTM Standard shall be waived.

The maximum temperature rating of cables relative to the diameter and coating of solid copper conductors or copper conductor strands shall not be higher than those shown in Table 1.

4.1.2 For stranded conductors, the length of lay of the strands shall not exceed 20 times the calculated diameter over the assembled conductor for No. 19 – 6 AWG conductor, or 30 times for No. 30 – 20 AWG conductor. The direction of lay of the strands may be right- or left-hand.

4.1.3 The conductors shall be continuous when tested in accordance with Clause 5.2.

4.1.4 The size of the copper conductor shall be determined either by means of the resistance shown in Tables 2 and 3, or by means of the dimensions shown in Table 4. In case of dispute, the resistance method shall be the referee method. Applications for various AWG sizes and conductor compositions are shown in Table 3A.

4.1.5 Resistance shall be determined in accordance with Clause 6.16.

4.1.6 Dimensions shall be determined in accordance with Clause 6.17.

4.1.7 A joint in a solid conductor or in one of the individual wires of a stranded conductor shall be made in a skillful manner, shall be essentially smooth, and shall not have any sharp projections.

A joint in a stranded conductor may be made by:

- a) Separately joining each individual wire; or

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