

UL 62

ISBN 0-7629-0206-X

Flexible Cord and Fixture Wire

Underwriters Laboratories Inc. (UL)
333 Pfingsten Road
Northbrook, IL 60062-2096

UL Standard for Safety for Flexible Cord and Fixture Wire, UL 62

Sixteenth Edition, Dated October 15, 1997

Revisions: This Standard contains revisions through and including April 13, 2000. UL is in the process of converting its Standards for Safety to the Standard Generalized Markup Language (SGML), and implementing an SGML compliant document management and publishing system. SGML - an international standard (ISO 8879-1986) - is a descriptive markup language that describes a document's structure and purpose, rather than its physical appearance on a page. Significant benefits that will result from UL's use of SGML and these new systems include increased productivity, reduced turnaround times, and data and information consistency, reusability, shareability, and portability. However, the fonts, pagination, and general formatting of UL's new electronic publishing system differ from that of UL's previous publishing system. Consequently, when revision pages are issued for a Standard with the new publishing system, these differences may result in the printing of pages on which no requirements have been changed - these additional pages result from relocation of text due to repagination and reformatting of the Standard with the new publishing system.

Announcement Bulletin(s): This Standard contains the announcement bulletin(s) dated October 30, 1997. The announcement bulletin is located at the end of the Standard (after the adoption bulletin(s)).

Text that has been changed in any manner is marked with a vertical line in the margin. Changes in requirements are marked with a vertical line in the margin and are followed by an effective date note indicating the date of publication or the date on which the changed requirement becomes effective.

The new and revised requirements are substantially in accordance with UL's Bulletin(s) on this subject dated August 14, 1998, March 29, 1999 and December 22, 1999. The bulletin(s) is now obsolete and may be discarded.

The revisions dated April 13, 2000 include a reprinted title page (page1) for this Standard.

As indicated on the title page (page1), this UL Standard for Safety has been adopted by the Department of Defense.

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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 note following the affected item. 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 "SUPERSEDED REQUIREMENTS" notice.

As of July 2, 1998, all products, including those previously evaluated by UL, must comply with this Standard.

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
1-4B	April 13, 2000
5.....	September 22, 1999
6	October 15, 1997
7	April 13, 2000
8-9	October 15, 1997
10-134	April 13, 2000
SR1-SR10	April 13, 2000

No Text on This Page

OCTOBER 15, 1997
(Title Page Reprinted: April 13, 2000)



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UL 62

Standard for Flexible Cord and Fixture Wire

First Edition – May, 1918
Second Edition – November, 1928
Third Edition – October, 1935
Fourth Edition – July, 1952
Fifth Edition – March, 1957
Sixth Edition – April, 1961
Seventh Edition – March, 1962
Eighth Edition – October, 1968
Ninth Edition – November, 1971
Tenth Edition – April, 1975
Eleventh Edition – April, 1978
Twelfth Edition – November, 1979
Thirteenth Edition – August, 1982
Fourteenth Edition – September, 1983
Fifteenth Edition – December, 1991

Sixteenth Edition

October 15, 1997

Approval as an American National Standard (ANSI) covers the numbered paragraphs on pages dated October 15, 1997, January 19, 1998, and June 23, 1998. These pages should not be discarded when revised or additional pages are issued if it is desired to retain the ANSI approved text.

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Approved as ANSI C33.1-1954, April 19, 1954
Approved as ANSI/UL 62-1985, January 8, 1985
Approved as ANSI/UL 62-1991, May 23, 1991
Approved as ANSI/UL 62-1999, April 23, 1999

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.

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.

ISBN 0-7629-0206-X

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FOREWORD

A. This Standard contains basic requirements for products covered by Underwriters Laboratories Inc. (UL) under its Follow-Up Service for this category within the limitations given below and in the Scope section of this Standard. These requirements are based upon sound engineering principles, research, records of tests and field experience, and an appreciation of the problems of manufacture, installation, and use derived from consultation with and information obtained from manufacturers, users, inspection authorities, and others having specialized experience. They are subject to revision as further experience and investigation may show is necessary or desirable.

B. The observance of the requirements of this Standard by a manufacturer is one of the conditions of the continued coverage of the manufacturer's product.

C. A product which complies with the text of this Standard will not necessarily be judged to comply with the Standard if, when examined and tested, it is found to have other features which impair the level of safety contemplated by these requirements.

D. A product employing materials or having forms of construction which conflict with specific requirements of the Standard cannot be judged to comply with the Standard. A product employing materials or having forms of construction not addressed by this Standard may be examined and tested according to the intent of the requirements and, if found to meet the intent of this Standard, may be judged to comply with the Standard.

E. UL, in performing its functions in accordance with its objectives, does not assume or undertake to discharge any responsibility of the manufacturer or any other party. The opinions and findings of UL represent its professional judgment given with due consideration to the necessary limitations of practical operation and state of the art at the time the Standard is processed. UL shall not be responsible to anyone for the use of or reliance upon this Standard by anyone. UL shall not incur any obligation or liability for damages, including consequential damages, arising out of or in connection with the use, interpretation of, or reliance upon this Standard.

F. Many tests required by the Standards of UL are inherently hazardous and adequate safeguards for personnel and property shall be employed in conducting such tests.

PREFACE

Effective Date

Between October 15, 1997 and July 2, 1998, new product submittals may be evaluated using all the requirements in this Standard, or if requested in writing, evaluated using the requirements in the Fifteenth edition of UL 62.

As of July 2, 1998, all products, including those previously evaluated by UL, must comply with this Standard.

INTRODUCTION

1 Scope

Section 1 effective July 2, 1998

1.1 These requirements cover fixture wires, hoistway cables, and flexible cords for use in accordance with the National Electrical Code.

1.2 An elevator cable that contains one or more optical-fiber members is limited (see 8.6) to carrying optical energy that has been ruled not hazardous to the human body.

1.3 These requirements do not cover armored cords or assemblies of flexible cords or fixture wires with fittings or wiring devices of any sort (such as cord sets, power-supply cords, and Christmas-tree and decorative-lighting outfits, which are covered in requirements separate from this standard) nor do these requirements cover any type of wire or cord for use at a potential higher than 600 V.

1.4 These requirements do not cover the optical or other performance of any optical-fiber member or group of such members. See 8.6.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involves a risk of fire, electric shock, or injury to persons shall be evaluated using appropriate additional component and end-product requirements to maintain the the level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard does not comply with this standard. Revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 Units of Measurement

Section 2 effective July 2, 1998

2.1 In addition to being stated in the inch/pound units that are customary in the USA, each of the requirements in this Standard is also stated in units that make the requirement conveniently usable in countries employing the various metric systems (practical SI and customary). Equivalent— although not necessarily exactly identical – results are to be expected from applying a requirement in USA or metric terms. Equipment calibrated in metric units is to be used when a requirement is applied in metric terms.

3 References

Section 3 effective July 2, 1998

3.1 Wherever the designation "UL 1581" is used in this wire Standard, reference is to be made to the designated part(s) of the Reference Standard for Electrical Wires, Cables, and Flexible Cords (UL 1581).

3.2 A fixture wire is a single conductor, whereas hoistway cable and flexible cord are assemblies of two or more conductors. Fixture wire has a solid conductor or either a 7-strand construction or a flexible stranding, whereas a flexible cord always has flexible stranding. Aside from the metal conductor itself, however, the requirements for fixture wire are essentially the same as for flexible cord.

3.3 It is to be noted that a flexible conductor is always stranded but that a stranded conductor is not necessarily flexible – for example, a 7-strand fixture wire is not a flexible conductor when compared with a wire having a larger number of finer strands.

CONSTRUCTION

GENERAL

4 Materials

Section 4 effective July 2, 1998

4.1 Each material used in a flexible cord, hoistway cable, or fixture wire shall be compatible with all of the other materials used in the cord or wire.

4.2 Due to possible incompatibility, TPE materials of the styrenic type may not be suitable for use in cords whereby direct contact with PVC may occur. A separator is one acceptable means of avoiding direct contact. Other combinations of materials which could be incompatible, if any, are as yet undetected.

5 Grounding Conductor

Section 5 effective July 2, 1998

5.1 No grounding conductor shall be included in any Type SPT-2W, SPT-1W, XTW, clock, CXTW, TPT, TST, or TS cord regardless of the size of the circuit conductors or in any of the cords described in 16.3.1.2 and 16.3.2.1, but one or more grounding conductors are acceptable (see 8.3, 8.4, and 8.7 for size) in any other cord in which the circuit conductors are 18 AWG or larger. A grounding conductor shall not be sectioned.

6 Index Tables

Section 6 effective July 2, 1998

6.1 A flexible cord, hoistway cable, or fixture wire shall be one of the types indicated in Tables 6.1 – 6.21 and shall comply in all respects with the requirements for construction and test performance that apply to the particular type.

6.2 Each of the Tables 6.1 – 6.21 serves as an index to the requirements for construction details and test performance of the types of fixture wire, hoistway cable, or flexible cord covered in the particular table.

6.3 Each vertical column serves as an index to the requirements that apply to the particular wire or cord whose type letters appear at the top of the column. The figures in parentheses are the numbers of the paragraphs in the text of this Standard to which reference should always be made. References in square brackets are to UL 1581.

Table 6.1
Rubber-insulated single-conductor fixture wires for temperatures not higher than 75°C

Table 6.1 revised April 13, 2000

Type-letter designation			RFH-2	FFH-2
Temperature rating			75°C (167°F)	
Maximum voltage			600	
AWG sizes of conductor			18 – 16	
Conductor	Material		Soft-annealed copper (7.1 and 7.2)	
	Dimensions		Diameters and cross-sectional area (8.1– 8.7, 9.1, and 9.2)	
	Stranding		Solid or 7-Strand	(11.1)
	Maximum length of lay of strands		7-Strand – 48 times diameter of individual strand (11.2) Flexible stranding (11.2)	
	General		Tinning, separators, splices, and continuity (12.1 – 14.1, Stranding, Section 10)	
Insulation	Class number ^c		31, 44	
	Minimum acceptable average thickness		30 mils or 0.76 mm (15.1 – 16.2.1)	30 mils or 0.76 mm (15.1 – 16.2.1)
	Minimum acceptable thickness at any point		(16.2.1)	
Braid or wrap			Covering optional for Type RFH-2 or FFH-2 with XLPE (Class 31) insulation. Otherwise: Solid or 7-strand – cotton braid (20.1.1– 20.3.3) ^b or wrap (21.1 – 21.6) ^b , Flexible stranding – cotton or rayon braid (20.1.1 – 20.3.3) ^b	
Tests on finished wire	Physical properties of insulation ^c	Unaged	31, 44	
		After aging		
	Conductor corrosion		[500.1 of UL 1581]	
	VW-1 flame test (optional)		(42.1)	
	Dielectric		(50.1)	
	Flexibility of braid or wrap		(20.1.1 and 21.1)	
	Durability of ink print		(64.1)	
Markings			(67.2, 68.1 – 68.3, 71.1, 74.1, 79.1, 81.1, 82.1, and 83.1)	
^a See 6.3				
^b In place of the braid or wrap specified, an extruded covering of material such as nylon or other thermoplastic may be used if investigation shows that the thickness, flexibility, temperature rating, and other characteristics of the construction that are critical to the application provide a comparable covering. A glass braid coated with lacquer or a saturating compound may be used in place of cotton or rayon.				
^c The physical properties requirements for individual materials are in UL 1581. See 47.1 and index Table 47.1 in UL 1581. For test methods see 40.2 of UL 1581.				

Table 6.2
PVC-insulated single-conductor fixture wires^a

Table 6.2 revised April 13, 2000

Type-letter designation			TF	TFF	TFN	TFFN
Temperature rating			60°C (140°F)		90°C (194°F)	
Maximum voltage			600			
AWG sizes of conductor			18 – 16			
Conductor	Material		Soft-annealed copper (7.1 and 7.2)			
	Dimensions		Diameters and cross-sectional area (8.1 – 8.7, 9.1, and 9.2)			
	Stranding		Solid or 7-Strand	36 – 26 AWG (11.1)	Solid or 7-Strand	36 – 26 AWG (11.1)
	Maximum length of lay of strands		7-Strand– 48 times diameter of individual strand (11.2) Flexible stranding (11.2)			
	General		Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)			
Insulation	Class number ^b		60°C Class 43		12B	
	Minimum acceptable average thickness		30 mils or 0.76 mm (15.1 – 16.2.1)		15 mils or 0.38 mm (15.1 – 16.2.1)	
	Minimum acceptable thickness at any point		(16.2.1)			
Braid or jacket			Braid optional (20.1.1 – 20.3.3)		Nylon jacket (28.3)	
Tests on finished wire	Physical properties of insulation	Unaged	60°C Class 43		12B	
		After aging				
	Conductor corrosion		[500.1 of UL 1581]			
	Heat-shock		(56.1)		(56.2)	
	VW-1/FT 1 flame test (optional)		(42.1)			
	Vertical flame test		(43.1)			
	Deformation		(57.1)		(57.3)	
	Cold-bend		(58.1)		(58.2)	
	Gasoline- and oil-resistant properties		(59.1 and 60.1)			
	Flexing of nylon jacket				(22.1)	
	Dielectric		(50.1)			
	Insulation resistance		(52.1 and 52.2)			
	Durability of ink print		(64.1)			
Markings			(67.2, 68.1, 68.2, 74.1, 79.1, 81.1, and 82.1)		(67.2, 68.1, 68.2, 68.5, 69.6, 71.1, 71.2, 73.1, 74.1, 79.1, 81.1, and 83.1)	

^a See 6.3

^b The physical properties requirements for individual materials are in UL 1581. See 47.1 and index Table 47.1 in UL 1581. For test methods see 40.2 of UL 1581.

Table 6.3
FEP- and PTFE-insulated single-conductor fixture wires^a

Table 6.3 revised April 13, 2000

Type-letter designation			PF	PFF	PGF	PGFF
Maximum temperature			200°C (392°F)	150°C (302°F)	200°C (392°F)	150°C (302°F)
Maximum voltage			600			
AWG sizes of conductor			18 – 14			
Conductor	Material		Soft-annealed copper (7.1 and 7.2)			
	Dimensions		Diameters and cross-sectional area (8.1 – 8.7, 9.1, and 9.2)			
	Stranding		Solid or 7-Strand	(11.1)	Solid or 7-Strand	(11.1)
	Maximum length of lay of strands		7-Strand – 48 times diameter of individual strand (11.2) Flexible stranding (11.2)			
Insulation	General		Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)			
	Class number ^c		12A			
	Minimum acceptable average thickness		20 mils or 0.51 mm (15.1 – 16.2.1)		14 mils or 0.36 mm (15.1 – 16.2.1)	
	Minimum acceptable thickness at any point		(16.2.1)			
Braid			Braid optional (20.1.1) ^b		Lacquered or varnished glass braid (20.1.1) ^b	
Tests on finished wire	Physical properties of insulation	Unaged	12A			
		After aging				
	Conductor corrosion		[500.1 of UL 1581]			
	VW-1 flame test		(42.1)			
	Vertical flame test		(43.1)			
	Deformation		(57.2)			
	Cold-bend		(58.1)			
	Dielectric		(50.1)			
	Insulation resistance		(52.3)			
	Flexibility of braid or wrap		(20.1.1)			
Durability of Ink Print		(64.1)				
Markings			(67.2, 68.1, 68.2, 68.3, 71.1, 71.2, 74.1, 79.1, 81.1, 82.1, and 83.1)			
^a See 6.3.						
^b A covering other than a lacquered or varnished glass braid is acceptable if investigation shows that the flexibility, temperature rating and other characteristics of the construction that are critical to the application provide a comparable covering.						
^c The physical properties requirements for individual materials are in UL 1581. See 47.1 and index Table 47.1 in UL 1581. For test methods see 40.2 of UL 1581.						

Table 6.4
Single-conductor fixture wires insulated with silicone, and XLPO^a

Table 6.4 revised April 13, 2000

			Silicone				XLPO	
Type-letter designation			SF-1	SF-2	SFF-1	SFF-2	XF	XFF
Maximum temperature			200°C (392°F)		150°C (302°F)			
Maximum voltage			300	600	300	600	300	
AWG sizes of conductor			18	18 – 14	18	18 – 14	18 – 10	
Conductor	Material		Soft-annealed copper or nickel (7.1 and 7.2)					
	Dimensions		Diameter and cross-sectional area (8.1 – 8.7, 9.1, and 9.2)					
	Stranding		(11.1)					
	Maximum length of lay of strands		7-Strand – 48 times diameter of individual strand (11.2) Flexible stranding (11.2)					
	General		Tinning, separators, splices, and continuity (12.1– 14.1, Section 10)					
Insulation	Class number ^d		22				38	
	Minimum acceptable average thickness		15 mils or 0.38 mm (15.1 – 16.2.1)	30 mils or 0.76 mm (15.1 – 16.2.1)	15 mils or 0.38 mm (15.1 – 16.2.1)	30 mils or 0.76 mm (15.1– 16.2.1)	18 – 14 AWG – 30 mils or 0.76 mm (15.1, 16.1.1, 16.2.1, 12 – 10 AWG – 45 mils or 1.14 mm	
	Minimum acceptable thickness at any point		(16.2.1)					
Braid			Glass braid (20.1.1) ^b				none	
Tests on finished wire	Physical properties of insulation ^d	Unaged	22				38	
		After aging						
	Conductor corrosion		[500.1 of UL 1581]					
	Flexibility of finished wire		[1560.1 of UL 1581]					
	VW-1 flame test		(42.1)					
	Vertical flame test		(43.1)					
	Dielectric		(50.1)					
	Insulation resistance		(55.1)				(54.1)	
	Deformation						(57.4)	
	Cold-bend						(58.5)	
	Flexibility of braid or wrap		(20.1)					
	Durability of ink print		(64.1)					
Markings		(68.1 – 68.3, 71.1, 71.2, 74.1, 79.1, 81.1, and 82.1)				(68.1, 68.2, 71.1, 71.2, 74.1, 79.1, 81.1, 82.1, and 83.1)		
^a See 6.3.								
^b A covering other than a glass braid is acceptable if investigation shows that the flexibility, temperature rating, and other characteristics of the construction that are critical to the application provide a comparable covering.								
^c The physical properties requirements for individual materials are in UL 1581. See 47.1 and index Table 47.1 in UL 1581. For test methods see 40.2 of UL 1581.								

Table 6.5
Tinsel cords^a

Table 6.5 revised April 13, 2000

			Parallel Tinsel Cords	Jacketed Tinsel Cords	
Type-letter designation			TPT ^c	TS	TST
Temperature rating			60°C (140°F)		
Maximum voltage			300		
AWG sizes of conductor			27		
Number of conductors			2 ^b		
Conductor	Material		Soft-annealed copper or nickel (7.1 and 7.2)		
	Dimensions		Not specified		
	Stranding		(11.3)		
	Maximum length of lay of strands		Not specified		
	General		Tinning, separators, splices (12.1 – 14.1, Section 10)		
Insulation	Class number ^d		2.9	2.4	2.9
	Minimum acceptable average thickness		30 mils or 0.76 mm (15.1, 16.2.1, and 16.3.1.1)	15 mils or 0.38 mm (15.1– 16.2.1)	
	Minimum acceptable thickness at any point		(15.1, 16.2.1, and 16.3.1.1)	13 mils or 0.33 mm (16.2.1)	
Braid on each conductor				Optional (20.1.1 – 20.3.3)	
Assembly of conductors			Parallel	Twisted together	
Maximum length of lay of conductors				(23.1)	
Fillers				Optional (24.1)	
Braid, wrap, or serving over assembly				Optional (Section 18)	
Jacket	Class number ^d			1.2	1.7
	Minimum acceptable average thickness		Jacket is integral with conductor insulation, and measurements of thickness of wall of insulation take care of the jacket thickness	30 mils or 0.76 mm (280.1 of UL 1581)	
	Minimum acceptable thickness at any point			24 mils or 0.61 mm (280.2 and 280.3 of UL 1581)	
	General			(25.1)	
Tests on finished insulated conductors or cord	Resistance of conductor		(11.3)		
	Physical properties of insulation ^d	Unaged	2.9	2.4	2.9
		After aging			
	Conductor corrosion		[500.1 of UL 1581]		
	Physical properties of jacket ^d	Unaged		1.2	1.7
		After aging			
	Heat Shock		(56.1)		(56.1)
	Cold Bend		(58.1)		
	Horizontal Flame		(44.1 and 44.2)		
	VW-1 Flame Test		(42.1)		
	Dielectric		(51.1)		
	Insulation resistance		(53.1)		(53.1)
	Resistance of nonintegral jacket			(31.1)	
Durability of ink print		(64.1)			
Deformation of jacket				53.1	
Polarity identification			(65.1.1, 65.4.1, 65.5.1, 65.6.1, and 65.7.1)	(65.1.1 – 65.4.1 and 65.8.1)	

Table 6.5 Continued on Next Page

Table 6.5 Continued

	Parallel Tinsel Cords	Jacketed Tinsel Cords	
Type-letter designation	TPT ^c	TS	TST
Markings	(68.1, 68.2, 68.4, 68.5, 74.1, 81.1, and 82.1)	(68.1, 68.2, 68.5, 69.1, 69.4, 74.1, 81.1, 82.1, and 83.1)	
^a See 6.3.			
^b Circuit conductors only. A grounding conductor is not acceptable (see 5.1).			
^c Shaver cord, which is the same as Type TPT except for the construction of the conductors [see 11.4] and the optional provision for separation of the conductors (see Figure 16.5 and Table 16.7) and the optional provision of grounded-conductor polarity identification (see 65.1), is limited to use in factory-assembled detachable and nondetachable power-supply cords for hand-held 50-W and smaller hair clippers and shaving appliances. See 74.1(d).			
^d The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.			

Table 6.6
Clock cord and decorative-lighting cords and wires^a

Revised Table 6.6 effective October 13, 2000

Descriptive name		Clock cord	Decorative-lighting cords		Decorative-lighting wire
Assembly of conductors		Parallel integral (29.1)	Parallel integral (16.3.1.1)	Twisted pair	Single conductor (16.1.1)
Use		Indoor	Aboveground	Aboveground	Aboveground
Type-letter designation		“clock cord”	XTW	CXTW	CXTW
Temperature rating		60°C (140°F) ^b	105°C (221°F)		
Maximum voltage		125	300	300	
AWG sizes of conductors (8.3)		20	22, 20, 18	22, 20, 18	
Number of conductors		2 circuit conductors, no grounding conductor (5.1)	2-6 circuit conductors, no grounding conductor (5.1)	2 circuit conductors, no grounding conductor (5.1)	1
CONDUCTOR	Material	Soft-annealed copper (7.1 and 7.2)			
	Dimensions	Cross-sectional area (8.1 – 8.7, 9.1, and 9.2)			
	AWG strand sizes	(11.1, 11.2)			
	Maximum strand lay length	1.25 inch or 32 mm (11.2)	22 AWG: tests (11.2) 20 AWG: 1.25 inch or 32 mm (11.2) 18 AWG: Table 11.2 or 11.3		
	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)			
INSULATION	Class number	2.9, 2.11	2.11		
	Nominal thickness or minimum acceptable average thickness	Nominal: 30 mils or 0.76 mm (29.1 and Table 16.7)	Nominal: 30 mils or 0.76 mm (Table 16.7)	Average: 30 mils or 0.76 mm (15.1–16.2.1)	Average: 30 mils or 0.76 mm (16.2.1 and Table 16.8)
	Minimum acceptable thickness	(16.2.1 and Table 16.7)		(16.2.1)	(16.2.1 and Table 16.8)
Maximum length of lay of conductors				30 x diameter over insulation on 1 conductor (23.1)	
Type-letter designation		“clock cord”	XTW parallel	CXTW twisted pair	CXTW 1 conductor

Table 6.6 Continued on Next Page

Table 6.6 Continued

Descriptive name			Clock cord	Decorative-lighting cords	Decorative-lighting wire	
Tests on finished wire or cord	Physical properties of insulation	Unaged	2.9, 2.11	2.11 [40.2 and Table 50.182 of UL 1581]		
		After aging				
	Conductor corrosion		[500.1 of UL 1581]			
	Heat shock		(56.1)			
	Deformation		(57.1)			
	Tightness of insulation		(17.1)		(17.2)	
	Cold bend		(38.1, 58.1)	(35.3, 35.4)	(35.3, 35.4)	(35.3, 35.4)
	Sunlight resistance			(35.2)		
	Insulation resistance	15.6°C (60°F)	(53.1)	(35.1)		
		50°C (122°F)				
	Flame tests	VW-1/FT1	Optional (42.1)	Required (42.1)		
		Required horizontal flame/FT2				
	Dielectric		(51.1)			(50.1)
	Durability of ink print		(64.1)			
Tests on No. 22 AWG per note ^b to Table 11.1	Abrasion		(61.1)			
	Flexing		(62.1)			
Polarity Identification				Optional except 2-conductor XTW (29.1)		
Markings			(68.1, 68.2, 68.5, 69.1 – 69.3, 74.1, 77.1, 79.1, 81.1, 82.1, and 83.1)			
^a See 6.3.						
^b The temperature limit is 105°C (221°F) if the clock-cord insulation is a Class 2.11 PVC.						
^c The physical properties requirements for individual materials are given in Table 15.2 of this Standard. For test methods see 40.2 of UL 1581.						

Table 6.7
Lamp and twisted portable braided types of cords^a

Revised Table 6.7 effective October 13, 2000

			Lamp cord	Twisted portable
Type-letter designation			C	PD
Temperature rating			60°C (140°F)	
Maximum Voltage			300 ^b	
AWG sizes of conductor			18 – 10	
Number of circuit conductors			2 or more	
Grounding conductor			One acceptable in addition to circuit conductors (5.1, 8.3, 8.4, 15.1– 15.4, 70.1, 71.1)	
Conductor	Material	Soft-annealed copper (7.1 and 7.2)		
	Dimensions	Cross-sectional area (8.1)		
	Stranding	(11.1 and 11.2)		
Insulation	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)		
	Class number ^e	2.4, 2.5, 2.9, 2.25		
	Minimal acceptable average thickness	18 – 16 AWG – 30 mils or 0.76 mm, 14 – 10 AWG – 45 mils or 1.14 mm (15.1 – 16.2.1)		
	Minimum acceptable thickness at any point	18 – 16 AWG – 27 mils or 0.69 mm, 14 – 10 AWG – 40 mils or 1.02 mm (15.1 – 16.2.1)		
Braid on each conductor			Cotton ^c (20.1)	
Assembly of conductors			Twisted together	
Maximum length of lay of conductors			(23.1)	
Fibrous fillers				Optional (Section 24)
Overall braid				Cotton or rayon (20.1.1)
Saturation of braid			d	
Tests on finished insulated conductors or cord	Physical properties of insulation ^e	Unaged	2.4, 2.5, 2.9, 2.25	
		After aging		
	Conductor corrosion		[500.1 of UL 1581]	
	Flexibility of braid		(20.1)	
	Cold bend		(54.1)	
	Horizontal flame/FT2		(44.1 and 44.2)	
	VW-1/FT1 flame test (optional)		(35.1)	
	Dielectric		(47.1)	
Insulation resistance		(53.1)		
Polarity identification			(65.1.1, 65.4.1, and 67.1)	
Markings			(68.1, 68.2, 68.5, 68.6, 69.4, 74.1, 79.1, 81.1, 82.1, and 83.1)	
^a See 6.3.				
^b The maximum voltage is 600, provided that the average thickness of insulation on the individual conductors is at least 45 mils or 1.14 mm.				
^c Spun rayon may be used in place of cotton for the braids on the individual conductors. See 20.1.4.				
^d A saturated braid is not required, but may be provided (see 20.3.1– 20.3.3) for cord used in damp locations. Type C cord with saturated braids is equivalent to a cord formerly known as “brewery cord”. Type PD cord with a saturated overall braid is equivalent to a cord formerly known as “canvasite cord”.				
^e The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.				

Table 6.8
Integral thermoset and TPE parallel cords^a

Table 6.8 revised April 13, 2000

Type-letter designation			SP-1	SPE-1	SP-2	SPE-2	SP-3	SPE-3
Temperature rating			60°C (140°F)	90°C (194°F) ^b	60°C (140°F)	90°C (194°F) ^b	60°C (140°F)	90°C (194°F) ^b
Voltage rating			300					
AWG Sizes of circuit conductors			20 – 18		18, 16		18 – 10	
Number of circuit conductors			2 or 3				2	
Grounding Conductor			One acceptable in addition to 2 circuit conductors but not in addition to 3 circuit conductors noted above (5.1, 8.3, 8.4, 15.1 – 15.4, 16.3.3.1 – 16.3.3.5, 16.3.3.7, 16.3.3.8, 65.1.1, 69.3, and 70.1)					
Conductor	Material		Soft-annealed copper (7.1 and 7.2)					
	Dimensions		Cross-sectional area (8.1 – 8.7)					
	Stranding		(11.1 and 11.2)					
	General		Tinning, separators, splices, and continuity (12.1 and 12.2, Section 10)					
Insulation	Class number ^c		2.4	2.20, 2.28	2.4	2.20, 2.28	2.4	2.20, 2.28
	Nominal thickness		30 mils or 0.76 mm		45 mils or 1.14 mm		(15.1 – 15.4, 16.1.1– 16.3.1.1, and 16.3.3.1 – 16.3.3.8)	
	Minimum acceptable thickness at any point		(15.1 – 15.4, 16.1.1 – 16.3.1.2, and 16.3.3.1)					
Tests on finished insulated conductors or cord	Physical properties of insulation ^c	Unaged	2.4	2.20, 2.28	2.4	2.20, 2.28	2.4	2.20, 2.28
		After aging						
	Conductor corrosion		[500.1 of UL 1581]					
	Heat shock			(56.1)		(56.1)		(56.1)
	Deformation			(57.6)		(57.6)		(57.6)
	Cold bend		(58.1)	(58.4)	(58.1)	(58.4)	(58.1)	(58.4)
	Tightness of insulation		(17.1)					
	Flame tests	Optional VW-1/ FT1	(42.1)					
		Required horizontal flame/FT2	(44.1 and 44.2)					
	Dielectric Withstand		(51.1)					
	Durability of ink print.		(64.1)					
Polarity identification			(16.3.3.2 – 16.3.3.6, 65.1.1, 65.5.1, 65.6.1, and 67.1)					
Markings			(68.1, 68.2, 68.5, 69.1, 70.1, Section 74, 77.1, 79.1, 81.1, 82.1, and 83.1)					
^a See 6.3.								
^b The temperature limit is 105°C (221°F) if the insulation and jacket are Class 2.20 and 1.14, respectively.								
^c The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.								

Table 6.8A
Non-integral thermoset and TPE parallel cords^a

Table 6.8A revised April 13, 2000

Type-letter designation			NISP-1	NISPE-1	NISP-2	NISPE-2
Temperature rating			60°C (140°F)	90°C (194°F) ^b	60°C (140°F)	90°C (194°F) ^b
Maximum voltage			300			
AWG Sizes of circuit conductors			20 – 18		18, 16	
Number of circuit conductors			2 or 3			
Grounding Conductor			One acceptable in addition to 2 circuit conductors but not in addition to 3 circuit conductors noted above (5.1, 8.3, 8.4, 15.1– 15.4, 16.3.3.2 – 16.3.3.6, 65.1.1, 69.3, and 70.1)			
CONDUCTOR	Material		Soft-annealed copper (7.1 and 7.2)			
	Dimensions		Cross-sectional area (8.1 – 8.7)			
	Stranding		(11.1 and 11.2)			
	General		Tinning, separators, splices, and continuity (12.1 and 12.2, Section 10)			
INSULATION	Class number ^c		2.4	2.20, 2.28	2.4	2.20, 2.28
	Nominal thickness		15 mils or 0.38 mm (15.1– 16.2.1)		30 mils or 0.76 mm (15.1 – 16.2.1)	
	Minimum acceptable thickness at any point		(15.1– 15.4, 16.1.1 – 16.3.1.2, and 16.3.3.1)			
JACKET	Class number ^c		1.2	1.14, 1.18	1.2	1.14, 1.18
	Minimum acceptable average thickness		(15.1 – 15.4, 16.1.1 – 16.3.3.8)			
	Minimum acceptable thickness at any point					
Overall Dimensions			Not specified			
Tests on finished insulated conductors or cord	Physical properties of insulation ^c	Unaged	2.4	2.20, 2.28	2.4	2.20, 2.28
		After aging				
	Physical properties of jacket ^c	Unaged	1.2	1.14, 1.18	1.2	1.14, 1.18
		After aging				
	Conductor corrosion		[500.1 of UL 1581]			
	Heat shock			(56.1)		(56.1)
	Deformation			(57.6)		(57.6)
	Cold bend		(58.1)	(58.4)	(58.1)	(58.4)
	Resistance of nonintegral jacket		(31.1)			
	Flame tests	Optional VW-1/FT1	(42.1)			
		Required horizontal flame/FT2	(44.1 and 44.2)			
	Dielectric Withstand		(51.1)			
	Durability of ink print.		(64.1)			
	Deformation of jacket			(57.6)		(57.6)
Polarity identification			(16.3.3.2 – 16.3.3.6, 65.1.1, 65.5.1, 65.6.1, and 67.1)			
Markings			(68.1, 68.2, 68.5, 69.1, 70.1, Section 74, 77.1, 79.1, 81.1, 82.1, and 83.1)			
^a See 6.3.						

Table 6.8A Continued on Next Page

Table 6.8A Continued

Type-letter designation	NISP-1	NISPE-1	NISP-2	NISPE-2
^D The temperature limit is 105°C (221°F) if the insulation and jacket are Class 2.20 and 1.14, respectively.				
^C The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.				

Table 6.9
Integral thermoplastic parallel cords^a

Table 6.9 revised April 13, 2000

Type-letter designation		SPT-1	SPT-1W	SPT-2	SPT-2W	SPT-3
Temperature rating		60°C (140°F) ^b	105°C (221°F)	60°C (140°F) ^b	105°C (221°F)	60°C (140°F) ^b
Maximum voltage		300				
AWG sizes of circuit conductors		20 – 18		18, 16		18 – 10
Number of circuit conductors		2 or 3	2	2 or 3	2	2
Grounding conductor		One acceptable in addition to 2 circuit conductors but not in addition to 3 circuit conductors noted above (5.1, 8.3, 15.3, 15.4, 16.3.3.2 – 16.3.3.5, 67.1, and 70.1)	None	One acceptable in addition to 2 circuit conductors but not in addition to 3 circuit conductors noted above (5.1, 8.3, 15.3, 15.4, 16.3.3.2– 16.3.3.5, 67.1, and 70.1)	None	One acceptable in addition to 2 circuit conductors (5.1, 8.3, 15.3, 15.4, 16.3.3.2 – 16.3.3.5, 67.1, and 70.1)
CONDUCTOR	Material	Soft-annealed copper (7.1 and 7.2)				
	Dimensions	Cross-sectional area (8.1 – 8.7)				
	Stranding	(11.1 and 11.2)				
	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)				
INSULATION	Circuit conductor class number ^c	2.9, 2.11, 2.22, 2.29				
	Grounding conductor class number ^c	2.9, 2.11, 2.13, 2.14, 2.20, 2.22, 2.26, 2.28, or 2.29	–	2.9, 2.11, 2.13, 2.14, 2.20, 2.22, 2.26, 2.28, or 2.29	–	2.9, 2.11, 2.13, 2.14, 2.20, 2.22, 2.26, 2.28, or 2.29
	Nominal thickness	30 mils or 0.76 mm		45 mils or 1.14 mm		(15.1 – 15.4, 16.1.1– 16.3.1.1, and 16.3.3.1 – 16.3.3.8)
	Minimum acceptable thickness at any point	(15.1 – 15.4, 16.1.1 – 16.3.1.1, and 16.3.3.1)				
JACKET	Class number ^c	Nylon optional (22.1) ^d				

Table 6.9 Continued on Next Page

Table 6.9 Continued

Type-letter designation			SPT-1	SPT-1W	SPT-2	SPT-2W	SPT-3
Tests on finished insulated conductors or cord	Physical properties of insulation ^c	Unaged	2.9, 2.11, 2.20, 2.22, 2.26, 2.28, 2.29	2.11	2.9, 2.11, 2.20, 2.22, 2.26, 2.28, 2.29	2.11	2.9, 2.11, 2.20, 2.22, 2.26, 2.28, 2.29
		After aging					
	Conductor corrosion		[500.1 of UL 1581]				
	Heat shock		(56.1)				
	Deformation		(57.1)				
	Tightness of insulation		(17.1)				
	Flexing of nylon jacket		(22.1)				
	Cold bend		(58.1, 58.3, 58.4)	(35.3, 35.4)	(58.1, 58.3, 58.4)	(35.3, 35.4)	(58.1, 58.3, 58.4)
	Sunlight resistance			(35.2)		(35.2)	
	Insulation resistance	15.6°C (60°F)	(53.1)	(35.1)	(53.1)	(35.1)	(53.1)
		50°C (122°F)		(35.5 – 35.7)		(35.5 – 35.7)	
	Flame tests	Optional VW-1/FT1	(42.1)				
		Required horizontal flame/FT2	(44.1 and 44.2)				
	Dielectric Withstand		(51.1)				
Durability of ink print			(64.1)				
Deformation of jacket			(57.1)				
Polarity identification			(16.3.3.2 – 16.3.3.6, 65.1.1, 65.5.1, 65.6.1, and 67.1)				
Markings			(68.1, 68.2, 68.5, 69.1, 70.1, Section 74, 77.1, 79.1, 81.1, 82.1, and 83.1)				

^a See 6.3.

^b The temperature limit dry is 75°C (167°F) or 90°C (194°F) or 105°C (221°F) if material(s) of those temperature ratings are employed.

^c The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.

^d Type SPT-1 cord rated at 105°C (221°F) for use with long-chain portable electric lamps shall employ a nylon jacket over the finished cord. Measured by means of the pin-gauge dial micrometer or one of the optical devices described in 250.9 and 250.10 of UL 1581, the average thickness of the nylon elsewhere than on the slopes and at the bottoms of the valleys shall not be less than 3 mils or 0.8 mm. Measured by means of one of the optical devices described in 250.9 and 250.10 of UL 1581, the minimum thickness of the nylon at any point on the slopes and at the bottoms of the valleys shall not be less than 1 mil or 0.03 mm.

Table 6.9A
Non-integral thermoplastic parallel cords^a

Table 6.9A revised April 13, 2000

Type-letter designation		NISPT-1	NISPT-2
Temperature rating		60°C (140°F) dry ^b	60°C (140°F) dry ^b
Maximum voltage		300	
AWG sizes of circuit conductors		20 – 18	18, 16
Number of circuit conductors		2 or 3	
Grounding conductor		One acceptable in addition to 2 circuit conductors but not in addition to 3 circuit conductors noted above (5.1, 8.3, 15.3, 15.4, 16.3.3.2– 16.3.3.5, 67.1, and 70.1)	One acceptable in addition to 2 circuit conductors but not in addition to 3 circuit conductors noted above (5.1, 8.3, 15.3, 15.4, 16.3.3.2– 16.3.3.5, 67.1, and 70.1)
CONDUCTOR	Material	Soft-annealed copper (7.1 and 7.2)	
	Dimensions	Cross-sectional area (8.1 – 8.7)	
	Stranding	(11.1 and 11.2)	
	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)	
INSULATION	Circuit conductor class number ^c	2.9, 2.11, 2.22, 2.29	
	Grounding conductor class number ^c	2.9, 2.11, 2.13, 2.14, 2.20, 2.22, 2.26, 2.28, or 2.29	
	Nominal thickness	15 mils or 0.38 mm (15.1 – 16.2.1)	30 mils or 0.76 mm (15.1 – 16.2.1)
	Minimum acceptable thickness at any point	(15.1– 15.4, 16.1.1 – 16.3.1.1, and 16.3.3.1)	
JACKET	Class number ^c	1.7, 1.8, 1.16, 1.19	
	Minimum acceptable average thickness	(15.1 – 15.4 and 16.1.1 – 16.3.3.6)	
	Minimum acceptable thickness at any point		
Overall dimensions		Not specified	

Table 6.9A Continued on Next Page

Table 6.9A Continued

Type-letter designation			NISPT-1	NISPT-2
Tests on finished insulated conductors or cord	Physical properties of insulation ^c	Unaged	2.9, 2.11, 2.20, 2.22, 2.26, 2.28, 2.29	
		After aging		
	Physical properties of jacket	Unaged	1.7, 1.8, 1.16, 1.19	
		After aging		
	Conductor corrosion		[500.1 of UL 1581]	
	Heat shock		(56.1)	
	Deformation		(57.1)	
	Resistance of nonintegral jacket		(31.1)	
	Cold bend		(58.1, 58.3, 58.4)	(58.1, 58.3, 58.4)
	Sunlight resistance			
	Insulation resistance	15.6°C (60°F)	(53.1)	(53.1)
		50°C (122°F)		
	Flame tests	Optional VW-1/FT1	(42.1)	
		Required horizontal flame/FT2	(44.1 and 44.2)	
Dielectric Withstand		(51.1)		
Durability of ink print			(64.1)	
Deformation of jacket			(57.1)	
Polarity identification			(16.3.3.2 – 16.3.3.6, 65.1.1, 65.5.1, 65.6.1, and 67.1)	
Markings			(68.1, 68.2, 68.5, 69.1, 70.1, Section 74, 77.1, 79.1, 81.1, 82.1, and 83.1)	
^a See 6.3.				
^b The temperature limit dry is 75°C (167°F) or 90°C (194°F) or 105°C (221°F) if material(s) of those temperature ratings are employed.				
^c The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.				

Table 6.10
Oil-resistant vacuum-cleaner cords^a

Table 6.10 revised April 13, 2000

Type-letter designation		SVOO ^b , SVO ^c	SVEO ^c , SVEOO ^b	SVTOO ^b , SVTO ^c
Temperature rating		60°C (140°F) ^d	90°C (194°F) ^f	60°C (140°F) ^d
Maximum voltage		300		
AWG sizes of conductors		18, 17, 16		
Number of conductors		2 or 3		
Grounding conductor		(5.1, 8.3, 8.4, 15.1 – 15.4, 23.1 and 67.1)		
Conductor	Material	Soft-annealed copper (7.1 and 7.2)		
	Dimensions	Cross-sectional area (8.1– 8.7)		
	Stranding	(11.1 and 11.2)		
	General	Tinning, separators, splices, and continuity (12.1– 14.1, Section 10)		
Insulation	Circuit conductor Class number ^e	2.4, 2.5, 2.5A, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.29
	Grounding conductor Class number ^e	2.4, 2.5, 2.5A, 2.13, 2.14, 2.16, 2.17, 2.23A, 2.30		
	Thicknesses	Average – 15.0 mils or 0.38 mm; minimum at any point – 13.0 mils or 0.33 mm (15.1– 16.2.1) (12 mils or 0.30 mm at line of contact between conductors)		
Braid or jacket on each conductor		Optional braid (Section 20) or optional nylon jacket: minimum 0.0002 inch or 0.05 mm (22.1)		
Assembly of conductors		Cabled		
Maximum length of lay of conductors		(23.1)		
Shielding		Optional (Section 39)		
Fillers		Optional (Section 24)		
Braid, wrap, or serving over assembly		Optional (Section 18)		
Type-letter designation		SVOO ^b , SVO ^c	SVEO ^c , SVEOO ^b	SVTOO ^b , SVTO ^c
Jacket	Class number ^e	1.2, 1.3, 1.10, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
	Minimum acceptable average thickness	30 mils or 0.76 mm [Section 280 of 1581]		
	Minimum acceptable thickness at any point	24 mils or 0.61 mm [Section 280 of UL 1581]		
	General	(27.1)		
Overall diameter		(Section 40)		

Table 6.10 Continued on Next Page

Table 6.10 Continued

Type-letter designation			SVOO ^b , SVO ^c	SVEO ^c , SVEOO ^b	SVTOO ^b , SVTO ^c
Tests on finished insulated conductors or cord	Physical properties of insulation ^e	Unaged	2.4, 2.5, 2.5A, 2.13, 2.14, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.29
		After aging			
	Physical properties of jacket ^e	Unaged	1.2, 1.3, 1.10, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
		After aging			
	Conductor corrosion		[500.1 of UL 1581]		
	Heat shock			(56.1)	
	Deformation			(57.6)	(57.1 and 57.6)
	Cold bend		(58.1)	(58.4)	(58.1 and 58.4)
	Resistance of nonintegral jacket		(31.1)		
	Mechanical strength		(41.1)		
	VW-1 flame test		(42.1)		
	Horizontal flame		(44.1 and 44.2)		
	Dielectric		(51.1)		
	Insulation resistance		(53.1)		
	Flexing of shielded cords		(63.1)		
Durability of ink print		(64.1)			
Polarity identification			(65.1.1, 65.4.1, 65.8.1, and 67.1)		
Markings			(68.1, 68.2, 68.5, 69.1 – 69.4, 69.6, 74.1, 79.1, 80.1, 81.1, 82.1, and 83.1)		
^a See 6.3.					
^b The OO in the type letters indicates that both the insulation and jacket are for continuous immersion in oil at temperatures not exceeding 60°C (140°F).					
^c The O in the type letters indicates that the jacket (not the insulation) is for continuous immersion in oil at temperatures not exceeding 60°C (140°F).					
^d If both the conductor insulation and the jacket are for use at the temperature in question, the temperature limits are: Type SVO or SVOO-75°C (167°F) or 90°C (194°F), SVTO or SVTOO-75°C (167°F) or 90°C (194°F) or 105°C (221°F). See 30.1.					
^e The physical properties requirements for individual materials are in given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.					
^f The temperature limit is 105°C (221°F) if both the conductor insulation and the jacket are of Class 2.20 and 1.14, respectively. See 30.1.					

Table 6.11
Non-oil-resistant vacuum-cleaner cords^a

Table 6.11 revised April 13, 2000

Type-letter designation		SV	SVE	SVT
Temperature rating		60°C (140°F) ^b	90°C (194°F) ^d	60°C (140°F) ^b
Maximum voltage		300		
AWG sizes of conductor		18 – 17 – 16		
Number of conductors		2 or 3		
Grounding conductor		(5.1, 8.3, 8.4, 15.1 – 15.4, 40.1, 41.1, and 67.1)		
Conductors	Material	Soft-annealed copper (7.1 and 7.2)		
	Dimensions	Cross-sectional area (8.1 – 8.7)		
	Stranding	(11.1 and 11.2)		
	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)		
Insulation	Circuit conductor Class number ^c	2.4, 2.5, 2.5A, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.29
	Grounding conductor Class number ^c	2.4, 2.5, 2.5A, 2.13, 2.14, 2.16, 2.17, 2.23A, 2.30		
	Thicknesses	Average – 15.0 mils or 0.38 mm; minimum at any point – 13.0 mils or 0.33 mm (15.1, 16.2.1) (12 mils or 0.30 mm at line of contact between conductors)		
Braid or jacket on each conductor		Optional braid (Section 20) or optional jacket: minimum 0.002 inch or 0.05 mm (22.1)		
Assembly of conductors		Cabled		
Maximum length of lay of conductors		(23.1)		
Shielding		Optional (Section 39)		
Fillers		Optional (Section 24)		
Braid, wrap, or serving over assembly		Optional (Section 18)		
Jacket	Class number ^c	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
	Minimum acceptable average thickness	30 mils or 0.76 mm [Section 280 of UL 1581]		
	Minimum acceptable thickness at any point	24 mils or 0.61 mm [Section 280 of UL 1581]		
	General	(27.1)		
Overall diameter		(Section 40)		

Table 6.11 Continued on Next Page

Table 6.11 Continued

Type-letter designation			SV	SVE	SVT
Tests on finished insulated conductors or cord	Physical properties of insulation ^c	Unaged	2.4, 2.5, 2.5A, 2.13, 2.14, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.29
		After aging			
	Physical properties of jacket ^c	Unaged	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
		After aging			
	Conductor corrosion		[500.1 of UL 1581]		
	Heat shock			(56.1)	(56.1)
	Deformation			(57.6)	(57.1 and 57.6)
	Cold bend		58.1	(58.4)	(58.1 and 58.4)
	Resistance of nonintegral jacket		(31.1)		
	Mechanical strength		(41.1)		
	VW-1 flame test		(42.1)		
	Horizontal flame		(44.1 and 44.2)		
	Dielectric		(51.1)		
	Insulation resistance		(53.1)		
	Flexing of shielded cords		(63.1)		
Durability of ink print		(64.1)			
Polarity Identification			(65.1.1, 65.4.1, 65.8.1, and 67.1)		
Markings			(68.1, 68.2, 68.5, 69.1 – 69.4, 69.6, 74.1, 79.1, 80.1, 81.1, 82.1, and 83.1)		
^a See 6.3.					
^b If both conductor insulation and jacket are for use at the temperature in question, the temperature limits are: Type SV – 75°C (167°F) or 90°C (194°F), SVT – 75°C (167°F), 90°C (194°F), or 105°C (221°F). See 30.1.					
^c The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.					
^d The temperature limit is 105°C (221°F) if both the conductor insulation and the jacket are of Class 2.20 and 1.14, respectively. See 30.1					

Table 6.12
Oil-resistant hard-service cords^a

Table 6.12 revised April 13, 2000

Type-letter designation		SJ00 ^b , SJ0OW ^b	SJO ^c , SJOW ^c	SJEO0 ^b , SJEOOW ^b , SJEO ^c , SJEOW ^c	SJTO0 ^b , SJTOOW ^b	SJTO ^c , SJTOW ^c
Temperature rating		60°C (140°F) ^d		90°C (194°F) ^f	60°C (140°F) ^d	
Maximum voltage		300				
AWG sizes of circuit conductors		18 – 10				
Number of circuit conductors		2 – 5				
Grounding conductor		One or more acceptable ^l (5.1, 8.4, 15.1 – 15.4, 32.3, 37.1, 41.1, 66.1, and 67.1)				
Conductor	Material	Soft-annealed copper (7.1 and 7.2)				
	Dimensions	Cross-sectional area (8.1 – 8.7)				
	Stranding	(11.1 and 11.2)				
	General	Tinning, separators, splices, and continuity (12.1– 14.1, Section 10)				
Insulation	Circuit conductor class number ^g	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30		2.20, 2.28	2.9, 2.11, 2.22, 2.24, 2.26 (low leakage-current), 2.29	
	Grounding conductor class number ^g	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30				
	Thicknesses	(Section 16)				
Braid or jacket on each conductor		Optional braid (Section 20) or optional nylon jacket: minimum 0.002 inch or 0.05 mm (22.1)				
Assembly of conductors		Cabled				
Maximum length of lay of conductors		(23.1)				
Shielding		Optional (Section 39)				
Fillers		Optional (Section 24)				
Braid, wrap, or serving over assembly		Optional (Section 18)				
Jacket	Class number ^g	1.2, 1.3, 1.10, 1.17, 1.20		1.14, 1.18	1.7, 1.8, 1.16, 1.19	
	Minimum acceptable average thickness	18 – 14 AWG: 30 mils or 0.76 mm; 12 AWG: 45 mils or 1.14 mm; 10 AWG: 60 mils or 1.52 mm; Table 28.3A; [Section 280 of UL 1581], Table 28.3A				
	Minimum acceptable thickness at any point	18 – 14 AWG: 24 mils or 0.61 mm; 12 AWG: 36 mils or 0.91 mm; 10 AWG: 48 mils or 1.22 mm [Section 280.2 of UL 1581]				
	General	(27.1)				
Overall diameter		(Section 40)				

Table 6.12 Continued on Next Page

Table 6.12 Continued

Type-letter designation			SJOO ^b , SJOOW ^b	SJO ^c , SJOW ^c	SJEOO ^b , SJEOOW ^b , SJEO ^c , SJEOW ^c	SJTOO ^b SJTOOW ^b	SJTO ^c , SJTOW ^c	
Tests on finished insulated conductors or cord	Physical properties of insulation ^g	Unaged	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30		2.20, 2.28		2.9, 2.11, 2.22, 2.24, 2.26, 2.29	
		After aging						
	Physical properties of jacket ^g	Unaged	1.2, 1.3, 1.10, 1.17, 1.20		1.14, 1.18		1.7, 1.8, 1.16, 1.19	
		After aging						
	Conductor corrosion		[500.1 of UL 1581]					
	Heat shock				(56.1)		(56.1)	
	Deformation				(57.6)		(57.1 and 57.6)	
	Cold bend	W Types	(32.6 and 32.7)					
		Other Types	(58.1)		(58.4)		(58.1 and 58.4)	
	Sunlight resistance of W Types		(32.5)					
	Swelling and blistering of thermoset jackets of W Types		(32.13)					
	Resistance of nonintegral jacket		(31.1)					
	Relative permittivity and stability factor of insulation of W Types		Thermosets and TPE (32.8 and 32.9)					
	A-C leakage current						Low-leakage-current cords (37.1)	
	Mechanical strength		(41.1)					
	Flame tests	Optional VW-1/FT1	(42.1)					
		Required horizontal/FT2	(44.1 and 44.2)					
	Dielectric		(51.1)					
	Insulation resistance (W Types)	15.6°C (60°F)	(32.4)					
		50°C (122°F)					(32.10 – 32.12)	
	Insulation resistance of indoor Types		(53.1)					
	Durability of ink print		(64.1)					
	Flexing of Shielded Cords		(63.1)					
Polarity identification			(65.1.1, 65.4.1, 65.8.1, and 67.1)					
Markings			(68.1, 68.2, 68.5, 69.1– 69.4, 69.6, 74.1, 76.1, 76.2, 76.3, 78.1, 79.1, 80.1, 81.1, 82.1, and 83.1)					

^a See 6.3.

^b The OO in the type letters indicates that both the insulation and jacket are for continuous immersion in oil at temperatures not exceeding 60°C (140°F).

^c The O in the type letters indicates that the jacket (not the insulation) is for continuous immersion in oil at temperatures not exceeding 60°C (140°F).

^d If both the conductor insulation and the jacket are for use at the temperature in question, the temperature limits are: Type SJO, SJOW, SJO, SJOOW, SJTO, SJTOW, SJTOOW, or SJTOO – 75°C (167°F) or 90°C (194°F) or 105°C (221°F). See 28.1.

^e The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.

^f The temperature limit is 105°C (221°F) if both the conductor insulation and the jacket are of Class 2.20 and 1.14 respectively. See 30.1.

Table 6.12 Continued on Next Page

Table 6.12 Continued

Type-letter designation	SJOOb, SJOOWb	SJOc, SJOWc	SJEOOb, SJEOOWb, SJEOc, SJEOWc	SJTOOb, SJTOOWb	SJTOc, SJTOWc
^g See 4.2 ^h Maximum combined number of circuit and grounding conductors is 6.					

Table 6.13
Non-oil-resistant hard-service cords^a

Table 6.13 revised April 13, 2000

Type-letter designation		SJ	SJE, SJEW	SJT, SJTW
Temperature rating		60°C (140°F) ^b	90°C (194°F) ^d	60°C (140°F) ^b
Maximum voltage		300		
AWG sizes of circuit conductors		18 – 10		
Number of circuit conductors		2 – 5		
Grounding conductor		One or more acceptable ^e (5.1, 8.4, 15.1 – 15.3, 23.1, 31.1, 37.1, 41.1, 66.1, and 67.1)		
Conductor	Material	Soft-annealed copper (7.1 and 7.2)		
	Dimensions	Cross-sectional area (8.1– 8.7)		
	Stranding	(11.1 and 11.2)		
	General	Tinning, separators, splices, and continuity (12.1– 14.1, Section 10)		
Insulation	Circuit conductor class number ^c	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.24, 2.26 (low-leakage-current), 2.29
	Grounding conductor class number ^c			2.9, 2.11, 2.22, 2.24, 2.26 (low-leakage-current), 2.29
	Thickness	(15.1 – 16.2.1)		
Braid or jacket on each conductor		Optional braid (Section 20) or optional nylon jacket: minimum 0.002 inch or 0.05 mm (22.1)		
Assembly of conductors		Cabled		
Maximum length of lay of conductors		(23.1)		
Shielding		Optional (Section 39)		
Fillers		Optional (Section 24)		
Braid, wrap, or serving over assembly		Optional (Section 18)		
Jacket	Class number ^c	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
	Minimum acceptable average thickness	18 – 14 AWG: 30 mils or 0.76 mm; 12 AWG: 45 mils or 1.14 mm; 10 AWG: 60 mils or 1.52 mm, Table 28.3A [Section 280 of UL 1581]		
	Minimum acceptable thickness at any point	18 – 14 AWG: 24 mils or 0.61 mm; 12 AWG: 36 mils or 0.91 mm; 10 AWG: 48 mils or 1.22 mm [Section 280 of UL 1581]		
	General	(27.1)		
Overall diameter		(Section 40)		

Table 6.13 Continued on Next Page

Table 6.13 Continued

Type-letter designation			SJ	SJE, SJEW	SJT, SJTW
Tests on finished insulated conductors	Physical properties of insulation ^e	Unaged	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.24, 2.26, 2.29
		After aging			
	Physical properties of jacket ^e	Unaged	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
		After aging			
	Conductor corrosion		[500.1 of UL 1581]		
	Heat shock			(56.1)	
	Deformation			(57.6)	(57.1 and 57.6)
	Cold bend	W Types	(32.6 and 32.7)		
		Other Types	(58.1)	(58.4)	(58.1)
	Sunlight resistance of W Types		(32.5)		
	Resistance of nonintegral jacket		(31.1)		
	Relative permittivity and stability factor of insulation of W Types			(32.8 and 32.9)	
	A-C leakage current				Low-leakage-current cords (37.1)
	Mechanical strength		(41.1)		
	Flame tests	Optional VW 1/FT1	(42.1)		
		Required horizontal flame/FT2	(44.1 and 44.2)		
	Dielectric		(51.1)		
	Insulation resistance (W Types)	15.6°C (60°F)		(32.4)	
		50° C (122° F)			Class 2.9, 2.11, 2.22, 2.29 PVC (32.10 – 32.12)
	Insulation resistance of indoor Types		(Section 53)		
	Durability of Ink Print		(64.1)		
	Flexing of Shielded Cords		(63.1)		
Polarity identification			(65.1.1, 65.4.1, 65.8.1, and 67.1)		
Markings			(68.1, 68.2, 68.5, 69.1 – 69.4, 69.6, 74.1, 76.1 – 76.3, 78.1, 79.1, 80.1, 81.1, 82.1, and 83.1)		

^a See 6.3.

^b If both the conductor insulation and the jacket are for use at the temperature in question, the temperature limits are: Type SJ, SJT, or SJTW – 75°C (167°F) or 90°C (194°F) or 105°C (221°F). See 30.1.

^c The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test method see 40.2 of UL 1581.

^d The temperature limit is 105°C (221°F) if both the conductor insulation and the jacket are of Class 2.20 and 1.14, respectively. See 30.1.

^e Maximum combined number of circuit and grounding conductors is 6.

Table 6.14
Oil-resistant extra-hard-service cords^a

Table 6.14 revised April 13, 2000

Type-letter designation		SOO ^b , SOOW ^b	SO ^c , SOW ^c	SEOOb ^b , SEOOW ^b , SEO ^c , SEOW ^c	STOO ^b , STOOW ^b	STO ^c , STOW ^c
Temperature rating		60°C (140°F) ^d		90°C (194°F) ^f	60°C (140°F) ^d	
Maximum voltage		600				
AWG sizes of circuit conductors		18 – 2				
Number of circuit conductors		2 or more				
Grounding conductor		One or more acceptable (5.1, 8.4, 15.1– 15.4, 37.1, 41.1, 66.1 and 67.1)				
Conductor	Material	Soft-annealed copper (7.1 and 7.2)				
	Dimensions	Cross-sectional area (8.1 – 8.7)				
	Stranding	(11.1 and 11.2)				
	General	Tinning, separators, splices, and continuity (12.1– 14.1, Section 10)				
Insulation	Circuit conductor class number ^e	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.29	2.9, 2.11, 2.22, 2.26 (low-leakage-current), 2.29	
	Grounding conductor class number ^e				2.9, 2.11, 2.22, 2.24, 2.26 (low-leakage-current), 2.29	
	Thicknesses	(Section 16)				
Braid or jacket on each conductor		Optional braid (Section 20) or optional nylon jacket: minimum 0.002 inch or 0.05 mm (22.1)				
Assembly of conductors		Cabled				
Maximum length of lay of conductors		(23.1)				
Shielding		Optional (Section 39)				
Fillers		Optional (Section 24)				
Braid, wrap, or serving over assembly		Optional (Section 18)				
Jacket	Class number ^h	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19		
	Minimum acceptable average thickness	(28.1)				
	Minimum acceptable thickness at any point					
	General	(27.1)				
Overall diameter		(Section 40)				

Table 6.14 Continued on Next Page

Table 6.14 Continued

Type-letter designation			SOO ^b , SOOW ^b	SO ^c , SOW ^c	SEOO ^b , SEOW ^b , SEO ^c , SEOW ^c	STOO ^b , STOOW ^b	STO ^c , STOW ^c
Tests on finished insulated conductors or cord	Physical properties of insulation ^d	Unaged	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30		2.20, 2.28	2.9, 2.11, 2.22, 2.29	2.9, 2.11, 2.22, 2.24, 2.26, 2.29
		After aging					
	Physical properties of jacket ^d	Unaged	1.2, 1.3, 1.10, 1.17, 1.20		1.14, 1.18		1.7, 1.8, 1.16, 1.19
		After aging					
	Conductor corrosion		[500.1 of UL 1581]				
	Heat shock			(56.1)			
	Deformation			(57.6)	(57.1 and 57.6)		
	Cold bend	W Types	(32.6 and 32.7)				
		Other Types	(58.1)	(58.4)	(58.1 and 58.4)		
	Sunlight resistance of W Types		(32.5)				
	Swelling and blistering of thermoset jackets of W Types		(32.13)				
	Resistance of nonintegral jacket		(31.1)				
	Relative permittivity and stability factor of insulation of W Types		(32.8 and 32.9)				
	A-C leakage current						Low-leakage-current cords (37.1)
	Mechanical strength		(41.1)				
	Flame tests	Optional VW-1/FT1	(42.1)				
		Required horizontal flame /FT2	(44.1 and 44.2)				
	Dielectric		(51.1)				
	Insulation resistance (W Types)	15.6°C (60°F)	(32.4)				
		50°C (122°F)					Class 2.9, 2.11, 2.22, 2.29 PVC (32.10 – 32.12)
	Insulation resistance of indoor Types		(53.1)				
	Durability of ink print		(64.1)				
	Flexing of shielded cords		(63.1)				
Polarity identification			(65.1.1, 65.4.1, 65.8.1, and 67.1)				
Markings			(68.1, 68.2, 68.5, 69.1– 69.4, 69.6, 75.1, 75.2, 76.1 – 76.3, 78.1, 79.1, 80.1, 81.1, 82.1, and 83.1)				

^a See 6.3.

^b The OO in the type letters indicates that both the insulation and jacket are for continuous immersion in oil at temperatures not exceeding 60°C (140°F).

^c The O in the type letters indicates that the jacket (not the insulation) is for continuous immersion in oil at temperatures not exceeding 60°C (140°F).

^d If both the conductor insulation and the jacket are for use at the temperature in question, the temperature limits are: Type SO or SOO, SO, SOOW, STO, STOO, STOW or STOOW – 75°C (167°F) or 90°C (194°F) or 105°C (221°F). See 30.1.

^e The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.

^f The temperature limit is 105°C (221°F) if both the conductor insulation and the jacket are of Class 2.20 and 1.14, respectively. See 30.1

Table 6.15
Non-oil-resistant extra-hard-service cords^a

Table 6.15 revised April 13, 2000

Type-letter designation		S	SE, SEW	ST, STW
Temperature rating		60°C (140°F) ^b	90°C (194°F) ^d	60°C (140°F) ^b
Maximum voltage		600		
AWG sizes of circuit conductors		18 – 2		
Number of circuit conductors		2 or more		
Grounding conductor		One or more acceptable (5.1, 8.3, 8.4, 15.1 – 15.3, 31.1, 37.1, 40.1, 41.1, 66.1, 67.1, and 69.3)		
Conductor	Material	Soft-annealed copper (7.1 and 7.2)		
	Dimensions	Cross-sectional area (8.1 – 8.7)		
	Stranding	(11.1 and 11.2)		
	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)		
Insulation	Circuit conductor class number ^f	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.26 (low-leakage-current), 2.29
	Grounding conductor class number ^f	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.17, 2.23A, 2.30		2.9, 2.11, 2.22, 2.24, 2.26 (low-leakage-current), 2.29
	Thickness	(Section 16)		
Braid or jacket on each conductor		Optional braid (Section 20) or optional nylon jacket: minimum 0.002 inch or 0.05 mm (22.1)		
Assembly of conductors		Cabled		
Maximum length of lay of conductors		(23.1)		
Shielding		(Section 39)		
Fillers		Optional (Section 24)		
Braid, wrap, or serving over assembly		Optional (Section 18)		
Jacket	Class number ^c	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
	Minimum acceptable average thickness	(28.1)		
	Minimum acceptable thickness at any point			
	General	(27.1)		
Overall diameter		(40.1 and 40.2)		

Table 6.15 Continued on Next Page

Table 6.15 Continued

Type-letter designation			S	SE, SEW	ST, STW
Tests on finished insulated conductors or cord	Physical properties of insulation ^c	Unaged	2.4, 2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.23A, 2.30	2.20, 2.28	2.9, 2.11, 2.22, 2.24, 2.26, 2.29
		After aging			
	Physical properties of jacket ^c	Unaged	1.2, 1.3, 1.10, 1.17, 1.20	1.14, 1.18	1.7, 1.8, 1.16, 1.19
		After aging			
	Conductor corrosion		[500.1 of UL 1581]		
	Heat shock			(56.1)	
	Deformation			(57.6)	(57.1 and 57.6)
	Cold bend	W Types	(32.6 and 32.7)		
		Other Types	(58.1)	(58.4)	(58.1)
	Sunlight resistance of W Types		(32.5)		
	Resistance of nonintegral jacket		(31.1)		
	Relative permittivity and stability factor of insulation of W Types		Thermosets and TPE (32.8 and 32.9)		
	A-C leakage current		Low-leakage-current cords (37.1)		
	Mechanical strength		(41.1)		
	Flame tests	Optional VW-1/FT1	(42.1)		
		Required horizontal/FT2	(44.1 and 44.2)		
	Dielectric		(51.1)		
	Insulation resistance (W Types)	15.6°C (60°F)	(32.4)		
		50°C (122°F)	Class 2.9, 2.11, 2.22, 2.29 PVC (32.10 – 32.12)		
	Insulation resistance of indoor Types		(53.1)		
	Durability of ink print		(64.1)		
	Flexing of shielded cords		(63.1)		
Polarity identification			(65.1.1, 65.4.1, 65.8.1, and 67.1)		
Markings			(68.1, 68.2, 68.5, 69.1 – 69.4, 69.6, 74.1, 75.1, 75.2, 76.1– 76.3, 78.1, 79.1, 80.1, 81.1, 82.1, and 83.1)		
^a See 6.3					
^b If both the conductor insulation and the jacket are for use at the temperature in question, the temperature limits are: Type S, SW, ST, or STW, SO or SOO or STO or STOO– 75°C (167°F) or 90°C (194°F) or 105°C (221°F). See 30.1.					
^c The physical properties requirements for individual materials are given in Tables 15.2 and 27.2 of this Standard. For test methods see 40.2 of UL 1581.					
^d The temperature limit is 105°C (221°F) if both the conductor insulation and the jacket are of Class 2.20 and 1.14, respectively. See 30.1.					

Table 6.16
Heater cords^a

Table 6.16 revised April 13, 2000

Type-letter designation		HSJ, HSJO ^c , HSJOO ^f	HS, HSO ^c , HSOO ^f	HPN
Temperature rating		90°C (194°F) ^d		90°C (194°F) ^e
Maximum voltage		300	300	300
AWG sizes of circuit conductors		18 – 12	14 – 12	18 – 12
Number of circuit conductors		2, 3, or 4		2 (16.3.3.2– 16.3.3.6 and 67.1)
Grounding conductor		One acceptable in addition to circuit conductors (5.1, 8.3, 8.4, 15.1 – 15.3, 66.1, 67.1, and 69.3.)		One (5.1, 8.3, 8.4, 15.1 – 15.4, 16.3.3.2– 16.3.3.6, 67.1, and 70.1)
Conductor	Material	Soft-annealed copper (7.1 and 7.2)		
	Dimensions	Cross-sectional area (8.1 – 8.7)		
	Stranding	(11.1 and 11.2)		
	General	Tinning, separators, splices, and continuity (12.1 – 14.1, Section 10)		
Insulation	Circuit conductor class number ^b	2.5, 2.5A, 2.15, 2.16, 2.17, 2.23A		2.5, 2.15, 2.16
	Grounding conductor class number ^b			2.5, 2.5A, 2.13, 2.14, 2.15, 2.16, 2.23A
	Minimum average thickness	18 – 16 AWG 30 mils or 0.76 mm, 14 – 12 AWG 45 mils or 1.14 mm (15.1 – 16.2.1)		(15.1 – 15.3, 16.1.1 – 16.3.1.1, and 16.3.3.1 – 16.3.3.8)
	Minimum thickness at any point	(16.2.1)		(same as above)
Braid on each conductor		Optional (Section 20)		
Assembly of conductors		Cabled		Parallel
Maximum length of lay of conductors		(23.1)		
Fillers		Optional (Section 24)		
Braid, wrap, or serving over assembly		Optional (Section 18)		
Jacket	Class number ^b	1.3, 1.10, 1.17	1.3, 1.10, 1.17	
	Minimum acceptable average thickness	30 mils or 0.76 mm [Section 280 of UL 1581]	60 mils or 1.52 mm [Section 280 of UL 1581]	
	Minimum acceptable thickness at any point	23 mils or 0.58 mm [Section 280 of UL 1581]	48 mils or 1.22 mm [Section 280 of UL 1581]	
	General	(27.1)		

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