CHAPTER 4. EQUIPMENT FOR GENERAL USE

Article 400 - Flexible Cords and Cables

A. General and Types

400-1. General. Flexible cords and cables and their associated fittings shall be suitable for the conditions of use and location.

400-2. Types. Cords of the several types shall conform to the descriptions of Table 400-11. Types of flexible cords other than those listed in Table 400-11 and other uses for types listed in Table, shall be the subject of special investigations and shall not be used before being approved.

B. Use and Installation

400-3. Use.

(a) Flexible cord may be used only for (1) pendants; (2) wiring of fixtures; (3) connection of portable lamps or appliances; (4) elevator cables; (5) wiring of cranes and hoists; (6) connection of stationary equipment to facilitate their frequent interchange; or (7) prevention of the transmission of noise or vibration; or (8) facilitating the removal or disconnection of fixed or stationary appliances for maintenance or repair.

(b) Where used as permitted in Sub-sections (a) (3), (a) (6), and (a) (8) of this Section, each flexible cord shall be equipped with an attachment plug and shall be energized from an approved receptacle outlet.

400-4. Prohibited Uses. Except where installed in accordance with Article 645, flexible cord shall not be used (1) as a substitute for the fixed wiring or a structure; (2) where run through holes in walls, ceilings, or floors; (3) where run through doorways, windows, or similar openings; (4) where attached to building surfaces; or (5) where concealed behind building walls, ceilings, or floors.

400-5. Splices. Flexible cord shall be used only in continuous lengths without splice or tap.

400-6. Cords in Show-Windows and Show-Cases. Flexible cord used in show-windows and show-cases shall be of types S, SO, SJ, SJO, ST, STO, SJT, SJTO and AFS, except for the wiring of chain supported fixtures, and for supplying current to portable lamps and other merchandise for exhibition purposes.

400-7. Minimum Size. Flexible cords shall not be smaller than No. 18, except that tinsel cords, or cords having equivalent characteristics, of smaller size may be approved for use with specific appliances.

400-8. Insulation - Over 300 Volts. Where the voltage between any two conductors exceeds 300, but does not exceed 600, flexible cord of No. 10 and smaller shall have rubber or thermoplastic insulation on the individual conductors at least 3/64 inch in thickness, unless type S, SO, ST or STO cord is used.

400-9. Overcurrent Protection and Ampacities of Flexible Cords.

(a) Overcurrent Protection. Flexible cords not smaller than No. 18, and tinsel cords, or cords having equivalent characteristics, of smaller size approved for use with specific appliances, shall be considered as protected against overcurrent by the overcurrent devices described in Section 240-5. Cords shall be not smaller than required in Table 400-9 (b) for the rated current of the connected equipment.

Table 400-9(b). Ampacity of Flexible Cord

Table 400-9(b) gives the allowable ampacity for not more than three current-carrying conductors in a cord. If the number of current-carrying conductors in a cord is from four to six, the allowable ampacity of each conductor shall be reduced to 80 per cent of the values for not more than three current-carrying conductors in the Table. A conductor used for equipment grounding and a neutral conductor which carries only the unbalanced current from other conductors, as in the case of normally balanced circuits of three or more conductors, are not considered to be current-carrying conductors. Where a single conductor is used for both equipment grounding and to carry unbalanced current from other conductors, it shall be considered to be a current-carrying conductor. (See Section 250-60.)

400-10. Pull at Joints and Terminals. Flexible cords shall be so connected to devices and to fittings that tension will not be transmitted to joints or terminal screws. This shall be accomplished by a know tin the cord, winding with tape, by a special fitting designed for that purpose, or by other approved means which will prevent a pull on the cord from being directly transmitted to joints or terminal screws.

Based on Ambient Temperature of 30°C (86°F)
See Section 400-9 and Table 400-11

Size AWG	Rubber Types TP, TS Thermoplastic Types TPT, TSP	Rubber Types PO, C, PD, E, EO, EN, S, SO, SRD, SJ, SJO, SV, SVO, SP Thermoplastic Types ET, ETP, ST, STO, SRDT, SJT, SJTO, SVT SVTO, SPT		Types AFS, AFSJ, HC, HPD, HSJ, HSJO, HS, HSO, HPN SVHT	Types AVPO AVPD	Cotton Types CFPD* Asbestos Types AFC* AFPD*
		A†	B†			
27**	0.5	..	..	..	..	..
18	..	7	10	10	17	6
17	..		..	12	..	..
16	..	10	13	15	22	8
15	..		..	17	..	..
14	..	15	18	20	28	17
12	..	20	25	30	36	23
10	..	25	30	35	47	28
8	..	35	40	..	..	..
6	..	45	55	..	..	..
4	..	60	70	..	..	..
2	..	80	95	..	..	..

*These types are used almost exclusively in fixtures where they are exposed to high temperatures and ampere ratings are assigned accordingly.

**Tinsel Cord.

†The ampacities under sub-heading A in Column 3 are applicable to three conductor cords and four conductor cords connected to utilization equipment, with three conductors carrying current. The ampacities under sub-heading B in Column 3 are applicable to two conductor cords and three conductor cords connected to the utilization equipment, with two conductors carrying current.

Note 1. Ultimate Insulation Temperature. In no case shall conductors be associated together in such way with respect to the kind of circuit, the wiring method employed, or the number of conductors, that the limiting temperature of the conductors will be exceeded.

Note 2. SVHT made only in No. 18 and 17 AWG sizes.

Notes to Table 400-11

1. Except for Types PO-1, PO-2, PO, SP-1, SP-2, SPT-1, SPT-2, TP, TPT, and AVPO, individual conductors are twisted together.

2. Type PO-1 is for use only with portable lamps, portable radio receiving appliances, portable clocks and similar appliances which are not liable to be moved frequently and where appearance is a consideration.

3. Types TP, TPT, TS, and TST are suitable for use in lengths not exceeding eight feet when attached directly, or by means of a special type of plug, to a portable appliance rated at 50 watts or less and of such nature that extreme flexibility of the cord is essential.

4. Rubber-filled or varnished cambric tapes may be substituted for the inner braids.

5. Types S, SO, and ST are suitable for use on theater stages, in garages and elsewhere, where flexible cords are permitted by this Code.

6. Traveling cables for operating, control and signal circuits may have one or more nonmetallic fillers or may have a supporting filler of stranded steel wires having its own protective braid or cover. Cables exceeding 100 feet in length shall have steel supporting fillers, except in locations subject to excessive moisture or corrosive vapors or gases. Where steel supporting fillers are used, they shall run straight through the center of the cable assembly and shall not be cabled with the copper strands of any conductor.

Types E, EO, and EN Cables may incorporate in the construction No. 20 Gauge Conductors formed as a pair, and covered with suitable metallic shielding for telephone circuits. The insulation of the conductors may be rubber or thermoplastic of thickness specified for Type E and EO Cables. The shield shall have its own protective covering. This component may be incorporated in any layer of the cable assembly, and shall not run straight through the center.

7. A third conductor in these cables is for grounding purposes only.

8. The individual conductors of all cords except those of heat-resistant cords (Types AFC, AFPD, AFS, AFSJ, AVPO, AVPD and CFPD) shall have a rubber or thermoplastic insulation, except that the grounding conductor where used, shall be in accordance with Paragraph 400-14(b). A rubber compound shall be vulcanized except for heater cords (Types HC, HPD and HSJ).

Table 400-11. Flexible Cord
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Parallel Tinsel Cord	TP See Note 3	27	2	Rubber	None	Rubber	Attached to an Appliance	Damp Places	Not Hard Usage
	TPT See Note 3	27	2	Thermo-plastic	None	Thermo-plastic	Attached to an Appliance	Damp Places	Not Hard Usage
Jacketed Tinsel Cord	TS See Note 3	27	2 or 3	Rubber	None	Rubber	Attached to an Appliance	Damp Places	Not Hard Usage
	TST See Note 3	27	2 or 3	Thermo-plastic	None	Thermo-plastic	Attached to an Appliance	Damp Places	Not Hard Usage
Asbestos-Covered Heat-Resistant Cord	AFC	18-10	2 or 3 2	Impreg-nated Asbestos	Cotton or Rayon None	None Cotton, Rayon or Saturated Asbestos	Pendant	Dry Places	Not Hard Usage
	AFPD		2 or 3						
Cotton-Covered Heat-Resistant Cord	CFPD	18-10	2 or 3 2 2 or 3	Impreg-nated Cotton	Cotton or Rayon None	None Cotton or Rayon	Pendant	Dry Places	Not Hard Usage

See Notes 1 through 8 preceding table.

Table 400-11. Flexible Cord - Continued
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Parallel Cord	PO-1 PO-2 PO	18 18-16 18-10	2	Rubber	Cotton	Cotton or Rayon	See Note 2 Pendant or Portable	Dry Places	Not Hard Usage
All Rubber Parallel Cord	SP-1 SP-2 See Note 7	18 18-16	2	Rubber	None	Rubber	Pendant or Portable	Damp Places	Not Hard Usage
	SP-3 See Note 7	18-12		Rubber	None	Rubber	Refrigerators or Room Air Conditioners	Damp Places	Not Hard
All Plastic Parallel Cord	SPT-1 SPT-2 See Note 7	18 18-16	2	Thermoplastic	None	Thermoplastic	Pendant or Portable	Damp Places	Not Hard Usage
All Plastic Parallel Cord	SPT-3 See Note 7	18-10	2	Thermoplastic	None	Thermoplastic	Refrigerators or Room Air Conditioners	Damp Places	Not Hard Usage
Lamp Cord	C	18-10	2 or more	Rubber	Cotton	None	Pendant or Portable	Dry Places	Not Hard Usage

See Notes 1 through 8 preceding table.

Table 400-11. Flexible Cord - Continued
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Twisted Portable Cord	PD	18-10	2 or more	Rubber	Cotton	Cotton or Rayon	Pendant or Portable	Dry Places	Not Hard Usage
Vacuum Cleaner Cord	SV, SVO SVT, SVTO See Note 7	18 18-17 18	2	Rubber Thermo-plastic	None	Rubber Thermo-plastic	Pendant or Portable	Damp Places	Not Hard Usage
Heat Resistant V.C. Cord	SVHT	18-17	2	Thermo-plastic	None	Thermo-plastic	Pendant or Portable	Damp Places	Not Hard Usage
Junior Hard Service Cord	SJ SJO SJT SJTO	18-16	2, 3, or 4	Rubber Thermo-plastic or Rubber	None	Rubber Oil Resistant Compound Thermo-plastic	Pendant or Portable	Damp Places	Hard Usage
Hard Service Cord	S See Note 5 SO ST STO	18-2	2 or more	Rubber Thermo-plastic or Rubber	None	Rubber Oil Resistant Compound Thermo-plastic Oil Resis. Thermo-plastic	Pendant or Portable	Damp Places	Extra Hard Usage

See Notes 1 through 8 preceding table.

Table 400-11. Flexible Cord - Continued
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Rubber-Jacketed Heat Resistant Cord	AFSJ	18-16	2 or 3	Impregnated Asbestos	None	Rubber	Portable	Damp Places	Portable Heaters
	AFS	18-16 14							
Heater Cord	HC	18-12	2, 3 or 4	Rubber and Asbestos	Cotton	None	Portable	Dry Places	Portable Heaters
	HPD	18-12	2, 3 or 4	Rubber w/Asbestos or All Neoprene	None	Cotton or Rayon			
Rubber Jacketed Heater Cord	HSJ	18-16	2, 3 or 4	Rubber w/Asbestos or All Neoprene	None	Cotton and Rubber	Portable	Damp Places	Portable Heaters
Jacketed Heater Cord	HSJO	18-16	2, 3 or 4	Rubber w/Asbestos or All Neoprene	None	Cotton and Oil Resistant Compound	Portable	Damp Places	Portable Heaters
	HS	14-12							
	HSO	14-12				Cotton and Rubber or Neoprene			
						Cotton and Oil Resistant Compound			

See Notes 1 through 8 preceding table.

Table 400-11. Flexible Cord - Continued
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Parallel Heater Cord	HPN See Note 7	18-12	2	Thermo-setting	None	Thermo-setting	Portable	Damp Places	Not Hard Usage
Heat and Moisture-Resistant Cord	AVPO	18-10	2	Asbestos and Var. Cam.	None	Asbestos, Flame-Ret. Moisture Resistant	Pendant or Portable	Damp Places	Not Hard Usage
	AVPD		2 or 3						
Range, Dryer Cable	SRD	10-4	3 or 4	Rubber	None	Rubber or Neoprene	Portable	Damp Places	Ranges, Dryers
	SRDT	10-4	3 or 4	Thermo-plastic	None	Thermo-plastic	Portable	Damp Places	Ranges, Dryers
Data Processing Cable	DPT	30 - Min.	2 or more	Thermo-plastic	None	Thermo-plastic	Data Processing Systems	Dry Places	Power and Signal Circuits

See Notes 1 through 8 preceding table.

Table 400-11. Flexible Cord - Continued
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use	
Elevator Cable	E See Note 6	18-14	2 or more	Rubber	Cotton	Three Cotton, Outer One Flame-Retardant & Moisture Resistant See Note 4	Elevator Lighting & Control	Non-Hazardous Locations
	EO See Note 6	18-14	2 or more	Rubber	Cotton	One Cotton and a Neoprene Jacket See Note 4	Elevator Lighting & Control	Hazardous Locations

See Notes 1 through 8 preceding table.

Table 400-11. Flexible Cord - Continued
(See Section 400-2)

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use	
Elevator Cable	EN See Note 6	18-14	2 or more	Rubber	Flexible Nylon Jacket	Three Cotton, Outer One Flame-Retardant & Moisture-Resistant See Note 4	Elevator Lighting and Control	Non-Hazardous Locations
						One Cotton and a Neoprene or Thermo-plastic Jacket See Note 4		Hazardous Locations
	ET See Note 6			Thermo-plastic	Rayon	Three Cotton, Outer One Flame-Retardant & Moisture-Resistant See Note 4		Non-Hazardous Locations
	ETP			Thermo-plastic	Rayon	Thermoplastic		Hazardous Locations

See Notes 1 through 8 preceding table.

C. Construction Specifications

400-12. Labels. Flexible cords shall be examined and tested at the factory and shall be labeled before shipment.

400-13. Grounded Conductor Identification. One conductor of flexible cords which is intended to be used as a grounded circuit conductor shall have a continuous marker readily distinguishing it from the other conductor or conductors. The identification shall consist of one of the following:

(a) Colored Braid. A braid finished to show a white or natural gray color and the braid on the other conductor or conductors finished to show a readily distinguishable solid color or colors.

(b) Tracer in Braid. A tracer in a braid of any color contrasting with that of the braid and no tracer in the braid of the other conductor or conductors. No tracer shall be used in the braid of any conductor of a flexible cord which contains a conductor having a braid finished to show white or natural gray, except, in the case of Types, C, PD and PO cords having the braids on the individual conductors finished to show white or natural gray. In such C, PD and PO cords the identifying marker may consist of the solid white or natural gray finish on one conductor provided there is a colored tracer in the braid of each other conductor.

(c) Colored Insulation. A white or natural gray insulation on one conductor and insulation of a readily distinguishable color or colors on the other conductor or conductors for cords having no braids on the individual conductors (except cords which have insulation on the individual conductors integral with the jacket). The insulation may be covered with an outer finish to provide the desired color.

(d) Colored Separator. A white or natural gray separator on one conductor and a separator of a readily distinguishable solid color on the other conductor or conductors of cords having insulation on the individual conductors integral with the jacket.

(e) Tinned Conductors. One conductor having the individual strands tinned and the other conductor or conductors having the individual strands untinned for cords having insulation on the individual conductors integral with the jacket.

(f) Surface Marking. A stripe, ridge or groove so located on the exterior of the cord as to identify one conductor for cords having insulation on the individual conductors integral with the jacket.

400-14. Grounding Conductor Identification. A conductor intended to be used as a grounding conductor shall have a continuous identifying marker readily distinguishing it from the other conductor or conductors. Conductors having a continuous green color or a continuous green color with one or more yellow stripes shall not be used for other than grounding purposes. The identifying marker shall consist of one of the following:

(a) Colored Braid. A braid finished to show a continuous green color

or a continuous green color with one or more yellow stripes.

(b) Colored Insulation or Covering. For cords having no braids on the individual conductors, an insulation of a continuous green color or a continuous green color with one or more yellow stripes.

400-15. Insulation Thickness. The nominal thickness of rubber or thermoplastic conductor insulation in Types TS, TST, PO-1, SV, SVT, and SVHT shall be not less than 1/64 inch. The nominal thickness of rubber insulation in Types HC, HPD, HSJ, and HS shall be not less than 1/64 inch for the Nos. 18-16 AWG sizes, and not less than 2/64 inch for the Nos. 14-12 AWG sizes. For heater cord other than Types HC and HPN, the all Neoprene insulation shall be 2/64 inch for No. 18 and No. 16 AWG sizes and 3/64 inch for No. 14 and No. 12 AWG sizes. The nominal thickness of the thermoplastic insulation in Type ET and ETP elevator cable shall be not less than 20 mils for the No. 18 and No. 16 AWG size and not less than 1/32 inch for the No. 14 AWG size. The nominal thickness of the rubber insulation in Types E, EO, and EN elevator cables shall be not less than 20 mils for the No. 18 and 16 AWG sizes and not less than 2/64 inch for the No. 14 AWG size for ratings not exceeding 300 volts. The nominal thickness of latex-rubber insulation, when employed, in Types SJ, SJO, S and SO shall be not less than 15 mils for the Nos. 18-16 AWG sizes and not less than 18 mils for the No., 14 AWG and larger sizes. The nominal thickness of conductor insulation in Types PO, SP-2, SPT-2, HPN, SRD, and SRDT shall be not less than 3/64 inch. The nominal thickness of thermoplastic insulation in Type SPT-3 shall be not less then 4/64 inch for sizes 18-16 and 5/64 inch for No. 14, 6/64 inch for No. 12 and 7/64 inch for No. 10 AWG. For other types, the minimum nominal thickness of rubber or thermoplastic conductor insulation shall be as follows: size AWG 27, and 18 to 16 - 2/64 inch; 14-10 - 3/64 inch; 8 to 2 - 4/64 inch.

400-16. Attached to Receptacle Plugs. Where a flexible cord is provided with a grounding conductor and equipped with an attachment plug, the plug shall comply with Paragraphs 250-59 (a and b).