

EQUIPMENT FOR GENERAL USE

Chapter E 400

FLEXIBLE CORDS

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A. GENERAL AND TYPES

E 400.01 General. Flexible cords shall be suitable for the conditions of use and location.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.02 Types. Cords of the several types shall conform to the descriptions of table E 400.11. Types of flexible cords other than those listed in table E 400.11 and other uses for types listed in the table, shall be the subject of special investigations and shall not be used before being approved.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

B. USE AND INSTALLATION

E 400.03 Use. Flexible cord may be used only for (1) pendants; (2) wiring of fixtures; (3) connection of portable lamps or appliances; (4) wiring of cranes and hoists; (5) for the connection of stationary equipment to facilitate their interchange; or (6) to prevent the transmission of noise or vibration.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.04 Prohibited uses. Flexible cord shall not be used (1) as a substitute for the fixed wiring of 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; (5) where concealed behind building walls, ceilings, or floors; or (6) above false ceilings.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.05 Splices. Flexible cord shall be used only in continuous lengths without splice or tap.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.06 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, SJT, or AFS, except for the wiring of chain supported fixtures, and for supplying current to portable lamps and other merchandise for exhibition purposes.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.07 Minimum size. Flexible cord 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.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.08 Insulation; over 300 volts. Where the voltage between any 2 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 or ST cord is used.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.09 Overcurrent protection and ampacities of flexible cords. (1) 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 Wis. Adm. Code section E 240.05. Cords shall be not smaller than required in table E 400.09 (2) for the rated current of the connected equipment.

(2) Table E 400.09 (2) 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 4 to 6, the allowable ampacity of each conductor shall be reduced to 80% of the values in the table. The ampacities for the sizes and types of three conductor cords connected to utilization equipment, where the third conductor is used for equipment grounding only and does not carry any load current, are given in notes 1 and 2 following the table.

TABLE E 400.09 (2)
AMPACITY OF FLEXIBLE CORD IN AMPERES
(Based on Room Temperature of 30°C, 86°F.)
 (See section E 400.09 and table E 400.11)

Size AWG	Rubber Types TP, TS	Rubber PO, C, PD, P, K, E, EO	Rubber Types S, SO, SRD, SJ, SJO, SV, SVO, SP,	Types AFS, AFSJ, HC, HPD, HSJ, HSJO, HS, HSO, HPN	Types AVPO, AVPD	Cotton Types CFC* CFPO* CFPD*
	Thermo- plastic Types TPT, TSP	Thermo- plastic Type ET	Thermoplas- tic Types ST, SFO, SRDT, SJT, SJTO, SVT, SVTO, SPT			Asbestos Types AFC* AFPO* AFPD*
27**	0.5					
18		5	7	10	17	6
17		7	10	12	22	8
16				15		
15				17		
14		15	15	20	28	17
12		20	20	30	36	28
10		25	25	35	47	28
8		35	35			
6		45	45			
4		60	60			
2		80				

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

**Tinsel cord.

Note 1. For Nos. 18, 16 and 14 AWG sizes of types S, SO, and ST Cords, the allowable ampacities are 10, 13 and 18 amperes respectively.

Note 2. For Nos. 18 and 16 AWG sizes of SJ, SJO and SJT Cords, the allowable ampacities are 10 and 13 amperes respectively.

Note 3. Ultimate insulation temperature. In no case shall conductors be associated together in such a 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.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 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 knot in 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.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

Notes to table E 400.11

1. Except for types AFPO, CFPO, 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 8 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. Type K is suitable for use on theatre stages.

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

6. Types S, SO, and ST are suitable for use on theatre stages, in garages and elsewhere, where flexible cords are permitted by this code.

7. 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. Type E and EO cables may incorporate in the construction #20 gauge conductors formed as a pair, and covered with suitable metallic braided 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.

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

9. The individual conductors of all cords except those of heat-resistant cords (types AFC, AFPO, AFPD, AFS, AFSJ, AVPO, AVPD, CFC, CFPO and CFPD) shall have a rubber or thermoplastic insulation except that the grounding conductor where used, shall be in accordance with section E 400.14 (2). A rubber compound shall be vulcanized except for header cords (types HC, HPD and HSJ) and for belt fillers in types P-1, P-2, and P.

TABLE E 400.11
FLEXIBLE CORD
 (See section E 400.02)

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	Thermoplastic	None	Thermoplastic	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	Thermoplastic	None	Thermoplastic	Attached to an Appliance	Damp Places	Not Hard Usage
Asbestos-Covered Heat-Resistant Cord	AFC	18-10	2 or 3	Impregnated Asbestos	Cotton or Rayon	None	Pendant	Dry Places	Not Hard Usage
	AFPO		2		None	Cotton, Rayon or Saturated Asbestos			
	AFPD		2 or 3		None	Cotton, Rayon or Saturated Asbestos			
Cotton-Covered Heat-Resistant Cord	CFC	18-10	2 or 3	Impregnated Cotton	Cotton or Rayon	None	Pendant	Dry Places	Not Hard Usage
	CFPO		2		None	Cotton or Rayon			
	CFPD		2 or 3		None	Cotton or Rayon			
Parallel Cord	PO-1	18	2	Rubber	Cotton	Cotton or Rayon	See Note 2	Dry Place	Not Hard Usage
	PO-2	18-16					Pendant or Port.		
	PO	18-10							

See Notes to Table E 400.11

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TABLE E 400.11—Continued

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
All Rubber Parallel Cord	SP-1	18	2	Rubber	None	Rubber	Pendant or Portable	Damp Places	Not Hard Usage
	SP-2 See Note 8	18-16		Rubber	None	Rubber	Refrigerators or Room Air Conditioners	Damp Places	Not Hard Usage
	SP-3 See Note 8	18-12							
All Plastic Parallel Cord	SPT-1	18	2	Thermoplastic	None	Thermoplastic	Pendant or Portable	Damp Places	Not Hard Usage
	SPT-2 See Note 8	18-16							
All Plastic Parallel Cord	SPT-3 Note 8	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
Twisted Portable Cord	PD	18-10	2 or more	Rubber	Cotton	Cotton or Rayon	Pendant or Portable	Dry Places	Not Hard Usage
Reinforced Cord	P-1	18	2 or more	Rubber	Cotton	Cotton over Rubber Filler	Pendant or Portable	Dry Places	Not Hard Usage
	P-2	18-16							Hard Usage
	P	18-10							
Braided Heavy Duty Cord	K See Note 4	18-10	2 or more	Rubber	Cotton	Two Cotton, Moisture-Resistant Finish See Note 5	Pendant or Portable	Damp Places	Hard Usage

See Notes to Table E 400.11

TABLE E 400.11—Continued

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Vacuum Cleaner Cord	SV, SVO	18	2	Rubber	None	Rubber	Pendant or Portable	Damp Places	Not Hard Usage
	SVT, SVTO See Note 8			Thermoplastic		Thermoplastic			
Junior Hard Service Cord	SJ	18-16	2, 3, or 4	Rubber	None	Rubber	Pendant or Portable	Damp Places	Hard Usage
	SJO			Thermoplastic or Rubber		Oil Resistant Compound			
	SJT			Thermoplastic		Thermoplastic			
	SJTO								
Hard Service Cord	S See Note 6	18-2	2 or More	Rubber	None	Rubber	Pendant or Portable	Damp Places	Extra Hard Usage
	SO			Oil Resistant Compound					
	ST			Thermoplastic					
	STO			Oil Resistant Thermoplastic					
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 with Asbestos or All Neoprene	None	Cotton or Rayon			
Rubber Jacketed Heater Cord	HSJ	18-16	2, 3, or 4	Rubber with Asbestos or All Neoprene	None	Cotton and Rubber	Portable	Damp Places	Portable Heaters

See Notes to Table E 400.11

TABLE E 400.11—Continued

Trade Name	Type Letter	Size AWG	No. of Conductors	Insulation	Braid on Each Conductor	Outer Covering	Use		
Jacketed Heater Cord	HSJO	18-16	2, 3, or 4	Rubber with Asbestos or All Neoprene	None	Cotton and Oil Resistant Compound	Portable	Damp Places	Portable Heaters
	HS	14-12				Cotton and Rubber or Neoprene			
	HSD	14-12				Cotton and Oil Resistant Compound			
Parallel Heater Cord	HPN	18-16	2	Thermosetting	None	Thermosetting	Portable	Damp Places	Portable Heaters
Heat and Moisture Resistant Cord	AVPO	18-10	2	Asbestos and Var. Camb.	None	Asbestos, Flame-ret. Moisture Resist.	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	Thermoplastic	None	Thermoplastic	Portable	Damp Places	Ranges Dryers
Elevator Cable	E See Note 7	18-14	2 or more	Rubber	Cotton	Three Cotton, Outer One Flame-Retardant and Moisture Resist. See Note 5 One Cotton and a Neoprene Jacket See Note 5	Elevator Lighting and Control	Non-Hazardous Locations	
	EO See Note 7							Hazardous Locations	
	ET See Note 7	18-14		Thermoplastic	Rayon	Three Cotton, Outer One Flame-Retardant and Moisture Resistant. See Note 5		Non-Hazardous Locations	

See Notes to Table E 400.11

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

C. CONSTRUCTION SPECIFICATIONS

E 400.12 Labels. Flexible cords shall be examined and tested at the factory and shall be labeled before shipment.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.13 Grounded conductor identification. One conductor of flexible cords shall have a continuous marker readily distinguishing it from the other conductor or conductors. The identification shall consist of one of the following:

(1) **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.

(2) **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.

(3) **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.

(4) **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.

(5) **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.

(6) **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.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 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 green covering shall not be used for other than grounding purposes. The identifying marker shall consist of one of the following:

(1) **COLORED BRAID.** A braid finished to show a continuous green color or a continuous green color with a yellow stripe.

(2) COLORED INSULATION OR COVERING. For cords having no braids on the individual conductors a continuous green color insulation or a continuous green color with a yellow stripe covering on one conductor.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 400.15 Insulation thickness. The nominal thickness of rubber or thermoplastic conductor insulation in types TS, TST, PO-1, P-1, SV, and SVT 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 HS and HPS, 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 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 and EO 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, P, 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 than 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 to 10—3/64 inch; 8 to 2—4/64 inch.

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.

E 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 sections E 250.059 (1) and (2).

History: Cr. Register, January, 1968, No. 145, eff. 2-1-68.