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Part I. General

A cord is a small cable, very flexible and substantially insulated to withstand wear. Flexible cord is the name given to wires used to connect portable appliances, small tools, etc. Flexible cords are also used to wire light fixtures from the box.



400.3. Flexible cords and cables and their fittings shall be suitable for the conditions of use and location. The rule may require the cord to be a "hard usage" (Type S cord) or "extra hard usage" (Type S or SO cord) if the cord is used where it is exposed to abrasion or dragging or repetitive flexing or pulling.

400.4. The type of flexible cords and cables shall conform to the specifications of Table 400.4.



400.5(A). Table 400.5(A)(1) lists the allowable ampacity for flexible cords and cables. Table 400.5(A)(2) lists ampacities of cable Types SC, SCE, SCT, PPE, G, G-GC, and W.

Where the number of current-carrying conductors exceeds three, the ampacity shall be reduced per Table 400.5(A)(3).

Table 400.5(A)(3) Adjustment Factors for More Than Three Current-Carrying Conductors in a Flexible Cord or Cable

Number of Conductors	Percent of Value in 400.5(A)(1) and 400.5(A)(2)
4-6	80%
7-9	70%
10-20	50%
21-30	45%
31-40	40%
41 and above	35%

A neutral conductor that carries only unbalanced current of the same circuit shall NOT be counted as current-carrying.

An equipment grounding conductor shall NOT be counted as current-carrying.

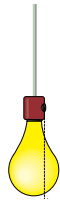


400.6(A). Flexible cords and cables shall be marked by a tag attached to the coil reel or carton.



400.10(A). Flexible cords and cables shall be used only for:

(1) Pendants



(2) Wiring of luminaires



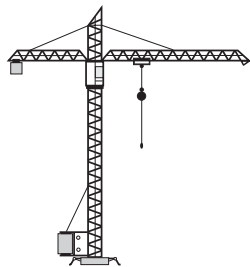
(3) Connection of portable luminaires, portable and mobile signs, or appliances



(4) Elevator cables



(5) Wiring of cranes and hoists



(6) Connection of utilization equipment to facilitate frequent interchange



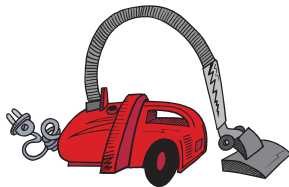
(7) Prevention of the transmission of noise or vibration



(8) Appliances designed to permit ready removal for maintenance and repair



(9) Connection of moving parts



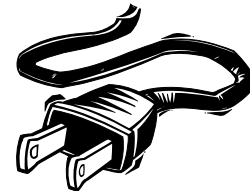
(10) Where permitted elsewhere in the Code



(11) Between an existing receptacle outlet and an inlet, where the inlet provides power to an additional single receptacle outlet



400.10(B). Cords where used for the connection of lamps, appliances, etc. shall be equipped with an attachment plug and shall be energized from a receptacle outlet or cord connector body.



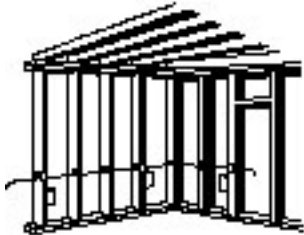
Editor's note: Fire departments respond to a fire every 16 seconds somewhere in the United States in the past year. A residential fire occurred every 74 seconds.

The abuse of cords is often a cause of an electrical fire. It's very important to understand the uses NOT permitted and why.

As an electrical inspector, I was taught you should see the entire length of a cord, you should be able to take the cord by the end and whip it. Which translates: The cord should not be hidden under a carpet, enclosed in a wall or ceiling, it should not be secured to the wall, etc.

400.12. Flexible cords and cables shall **NOT** be permitted:

(1) As a substitute for fixed wiring of a structure



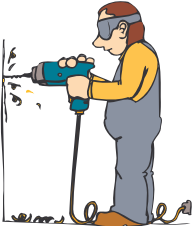
(2) Where run through holes in walls, ceilings or floors



(3) Where run through doorways, windows, etc.



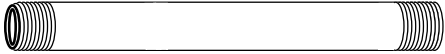
(4) Where attached to building surfaces



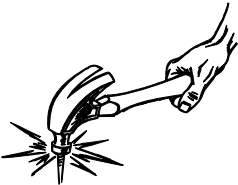
(5) Where concealed



(6) Where installed in raceways, unless permitted by the Code

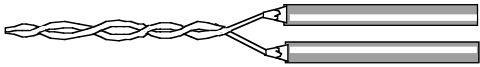


(7) Where subject to physical damage



400.13. Flexible cord shall be used only in continuous lengths without splice or tap. The repair of hard-service cord and junior hard-service cord size #14 and larger shall be permitted if conductors are spliced per 110.14(B).

Splices shall be properly joined together mechanically rather than soldered. All splices shall be insulated with a material having a dielectric value equal to the original conductor insulation.

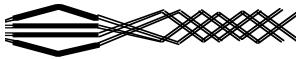
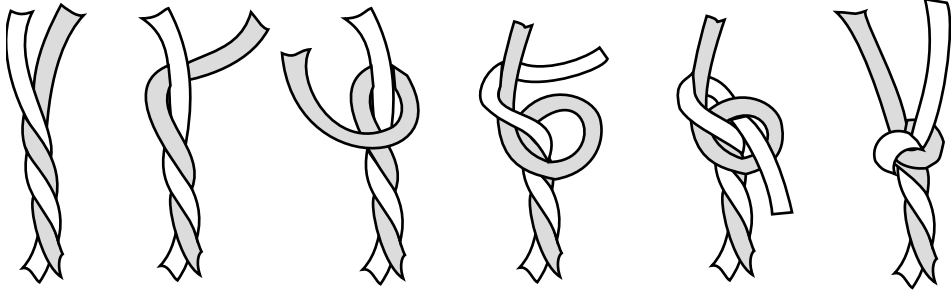


All splices shall be covered with an insulation *equivalent* to that of the conductors.



400.14. Flexible cords and cables shall be connected so that tension is not transmitted to joints or terminals.

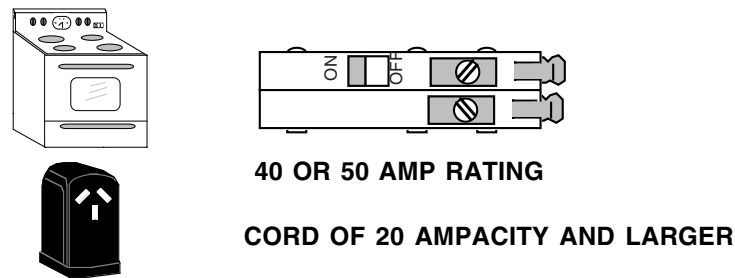
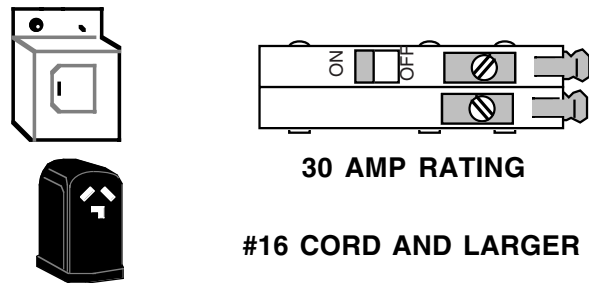
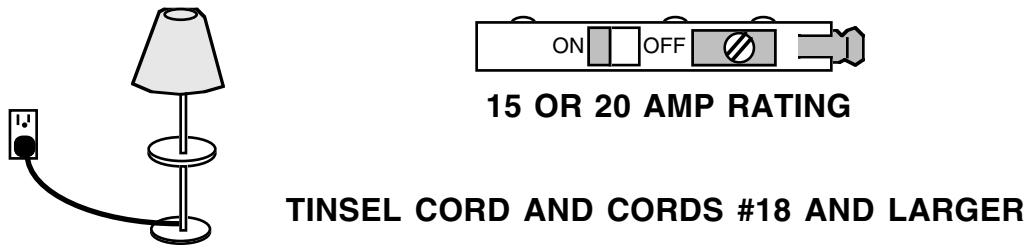
Informational Note: Some methods of preventing pull on a cord are knotting the cord, winding with tape, and fittings designed for the purpose.



400.16. Overcurrent protection per 240.5.

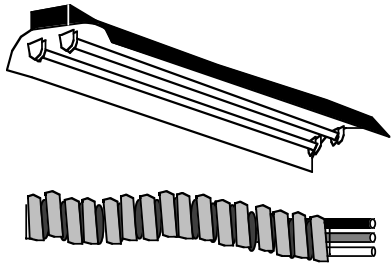
240.5. Flexible cord, tinsel cord and extension cords shall be protected in accordance with their ampacities from Table 400.5(A)(1) and 400.5(A)(2). Fixture wire is protected in accordance with Table 402.5. Supplementary overcurrent protection shall be permitted.

A flexible cord or tinsel cord (not extension cords) with a listed appliance or lamp is connected to a branch circuit using Article 210. The following overcurrent protection is permitted instead of the ampacity values from Table 400.5(A)(1) and (A)(2):



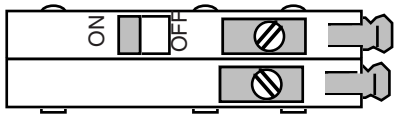
400.16

240.5(B)(2). This lists the conditions which fixture wires can be used without following the ampacity requirements of Table 402.5.



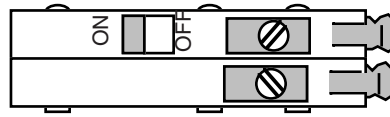
15 OR 20 AMP RATED 120v or higher

- #18 FIXTURE WIRE UP TO 50'**
- #16 FIXTURE WIRE UP TO 100'**
- #14 FIXTURE WIRE AND LARGER**



30 AMP RATED

#14 FIXTURE WIRE AND LARGER



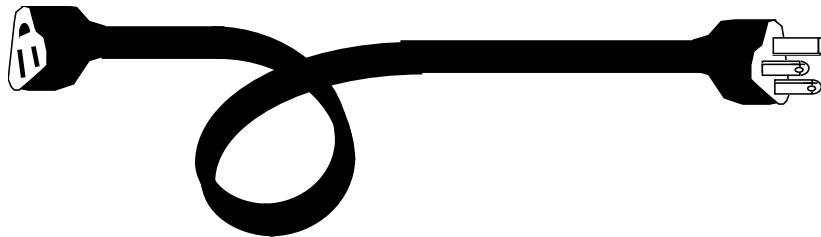
40 or 50 AMP RATED

#12 FIXTURE WIRE AND LARGER

240.5(B)(4). Any listed extension cord using #16 wire or larger shall be considered as protected on a 20 rated circuit.

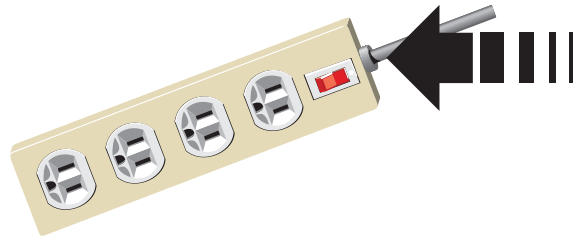


20 AMP RATED



UL LISTED EXTENSION CORD #16 AWG

400.17. Flexible cords and cable shall be protected by bushings or fittings where passing through holes in covers, boxes, etc.



In industrial establishments where the conditions of maintenance and supervision ensure that only qualified persons service the installation, flexible cords and flexible cables shall be permitted to be installed in aboveground raceways that are no longer than 50 feet to protect the flexible cords or flexible cables from physical damage. Where more than three current carrying conductors are installed within the raceway, the ampacity shall be adjusted in accordance with Table 400.5(A)(3).

Part II. Construction Specifications

400.22. Flexible cords having one conductor that is intended to be used as the grounded conductor shall have a continuous marker that distinguishes it from the other conductors, such as:

(A) A white or gray colored braid.



(B) A tracer in a braid of any color contrasting with that of the braid and no tracer in the braid of the other conductors.



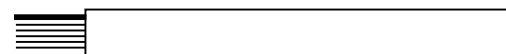
(C) A white or gray insulation.



(D) A white or gray separator.



(E) One conductor tinned.



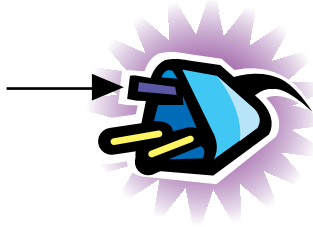
(F) One or more ridges, grooves or white stripes on the exterior of the cord.



400.23. The equipment grounding conductor shall have a continuous green color or green with one or more yellow stripes.



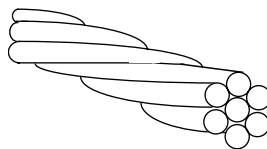
400.24. A flexible cord provided with an equipment grounding conductor and attachment plug, the attachment plug shall have one fixed grounding contact.



Part III. Portable Cables Over 600 Volts, up to 2000 volts.

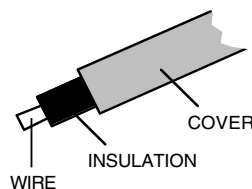


400.31(A). Portable cable conductors shall be *flexible stranded* #12 copper or larger.



400.31(B). Portable cables over 600 volts shall have an equipment grounding conductor provided.

400.32. All shields shall be connected to an equipment grounding conductor.



Part IV. Portable Power Feeder Cables Over 2,000 Volts

400.42. Uses Permitted. Portable power feeder cables over 2,000 Volts shall be used for the following:



- (1) Connection of portable equipment and machinery or for the wiring of cranes and hoists
- (2) Temporary services and installations

400.43. Uses NOT Permitted. Portable power feeder cables over 2,000 Volts shall NOT be used for the following:

- (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 buildings surfaces
- (5) Where concealed by walls, ceilings, or floors
- (6) Where installed in raceways, except as otherwise permitted in this Code
- (7) Where subject to physical damage

400.44 Construction.



- (A) The conductors shall be #6 AWG or larger and shall employ flexible stranding.



400.45 Shielding. All shields shall be grounded at least at one end.



400.46 Equipment Grounding Conductors. Equipment grounding conductors shall be connected in accordance with Parts VI and VII of Article 250.

Articles 430-495 Quiz #11 - Open Book

1. Which is the requirement for a dry-type transformer rated 112 1/2 kVA or less installed indoors?

- (a) It shall be installed in a vault.**
- (b) Dry-type transformers shall not be installed indoors.**
- (c) It shall be installed in a room of fire-resistant construction.**
- (d) It shall have a separation of at least 12" from combustible materials.**

2. #12 copper conductors which extend beyond a motor control equipment enclosure shall be permitted to be protected by the motor branch-circuit protective device if its rating is not more than ____ amperes.

- (a) 25**
- (b) 30**
- (c) 50**
- (d) 60**

3. A room air conditioner rated 3-phase or rated over 250 volts shall be connected ____.

- (a) directly to the wiring**
- (b) with a grounding plug**
- (c) with a 3-prong attachment plug**
- (d) with a 4-prong attachment plug**

4. An inverse time circuit breaker that is used as both controller and disconnecting means is permitted to be operated by ____ attachment to the handle or lever.

- (a) power**
- (b) manual**
- (c) actuator**
- (d) a, or b**

5. The motor nameplate full-load current rating is used for sizing the ____.

- (a) branch circuit conductors**
- (b) motor disconnecting device**
- (c) branch circuit short circuit fuse**
- (d) motor overload protection device**

6. The disconnecting means serving a hermetic refrigerant motor-compressor shall be selected on the basis of the nameplate rated-load current or branch-circuit selection current of the motor-compressor. The ampere rating shall be at least ____ of the nameplate rated-load current.

- (a) 75%**
- (b) 80%**
- (c) 100%**
- (d) 115%**

Articles 430-495 Quiz #11 - Open Book

7. The ampacity of conductors that connect a capacitor to the terminals of a motor shall not be less than ____ of the ampacity of the motor circuit conductors.

- (a) 33% (b) 50% (c) 75% (d) 80%**

8. DC motors operating from a rectifier bridge of the single-phase half-wave power supply, the conductors between the field wiring terminals of the rectifier and the motor shall have an ampacity of not less than ____ of the motor full-load current rating.

- (a) 120% (b) 125% (c) 150% (d) 190%**

9. Single-phase cord-and-plug-connected room air conditioners shall be provided with factory-installed LCDI or AFCI protection. The LCDI or AFCI protection shall be an integral part of the attachment plug or be located in the power supply cord within 300 mm or ____ in. of the attachment plug.

- (a) 12 (b) 14 (c) 20 (d) 30**

10. Adjustable Speed Drive Systems the incoming branch circuit or feeder to power conversion equipment included as a part of an adjustable-speed drive system shall be based on the rated input to the power conversion equipment. Where the power conversion equipment is marked to indicate that overload protection is included, additional _____ protection shall not be required.

- (a) lockout (b) overload (c) disconnect (d) fuses**

11. Transformers rated ____ kVA or larger are required to have their impedance marked on the nameplate.

- (a) 7.5 (b) 12 (c) 15 (d) 25**

12. Over 1000v, mechanical ____ shall be provided in the housing to prevent the complete withdrawal of the circuit breaker from the housing when the stored energy mechanism is in the fully charged position, unless a suitable device is provided to block the closing function of the circuit breaker before complete withdrawal.

- (a) relay (b) lever (c) interlocks (d) reset**

FINAL EXAM

