

Chapter E 410

LIGHTING FIXTURES, LAMPHOLDERS, LAMPS,
RECEPTACLES AND ROSETTES

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A. GENERAL

E 410.01 Scope. Lighting fixtures, lampholders, pendants, receptacles, rosettes, incandescent filament lamps, arc lamps, electric discharge lamps, the wiring and equipment forming part of such lamps, fixtures and lighting installations shall conform to the provisions of this chapter, except as otherwise provided in this code.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.02 Application to other chapters. Equipment for use in hazardous locations shall conform to chapters E 500 to E 517.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.03 Live parts. Fixtures, lampholders, lamps, rosettes and receptacles shall have no live parts normally exposed to contact, except in the case of cleat-type lampholders, receptacles and rosettes which are located at least 8 feet above the floor. Lampholders, receptacles and switches which have exposed accessible terminals shall not be installed in metal fixture canopies or in open bases of portable table or floor lamps.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

B. PROVISIONS FOR FIXTURE LOCATIONS

E 410.04 Fixtures in damp, wet or corrosive locations. (1) Fixtures installed in damp or wet locations shall be approved for such locations and shall be so constructed or installed that water cannot enter or accumulate in wireways, lampholders or other electrical parts.

(2) Fixtures installed in corrosive locations shall be of a type approved for such locations.

Note: See subsection E 210.21 (2) for receptacles in fixtures.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.05 Fixtures near combustible material. Fixtures shall be so constructed, or installed, or equipped with shades or guards that combustible material will not be subjected to temperatures in excess of 90°C. (194°F.).

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.06 Fixtures over combustible material. Lampholders installed over highly combustible material shall be of the unswitched type and unless an individual switch is provided for each fixture, shall be located at least 8 feet above the floor, or shall be otherwise so located or guarded that the lamps cannot be readily removed or damaged.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.07 Fixtures in show-windows. Externally wired fixtures shall not be used in a show-window.

(1) Exception: Fixtures of the chain-supported type may be externally wired.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.08 Fixtures in clothes closets. (1) Fixtures in clothes closets shall be installed on the ceiling or on the wall above the door.

(2) Pendants shall not be installed in clothes closets.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.09 Space for cove lighting. Coves shall have adequate space and shall be so located that lamps and equipment can be properly installed and maintained.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

C. PROVISIONS AT FIXTURE OUTLET BOXES, CANOPIES AND PANS

E 410.10 Space for conductors. Canopies and outlet boxes taken together shall provide adequate space so that fixture conductors and their connecting devices may be properly installed.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.11 Temperature limit of conductors in outlet boxes. Fixtures shall be of such construction or so installed that the conductors in outlet boxes shall not be subjected to temperatures greater than that for which the conductors are approved.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.12 Outlet boxes to be covered. In a completed installation, each outlet box shall be provided with a cover unless covered by means of a fixture canopy, lampholder, receptacle, rosette, or similar device.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.13 Covering of combustible material at outlet boxes. Any combustible wall or ceiling finish exposed between the edge of a fixture canopy or pan and an outlet box shall be covered with non-combustible material.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.14 Connection of fixtures. In general, fluorescent fixtures when supported independently of the outlet box shall be connected through metal raceways or armored conductors. This requirement may be waived when cord-equipped fixtures are suspended directly below the outlet box and the exposed cord is not subject to strain or physical damage.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

D. FIXTURE SUPPORTS

E 410.15 Supports; general. Fixtures, lampholders, rosettes and receptacles shall be securely supported. A fixture which weighs more than 6 lbs. or exceeds 16 inches in any dimension shall not be supported by the screw shell of a lampholder.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.16 Means of support. Where the outlet box or fitting will provide adequate support, a fixture shall be attached thereto; otherwise a fixture shall be supported as required by section E 370.13. A fixture which weighs more than 50 lbs. shall be supported independently of the outlet box.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E. WIRING OF FIXTURES

E 410.17 Fixture wiring; general. Wiring on or within fixtures shall be neatly arranged and shall not be exposed to physical dam-

age. Excess wiring shall be avoided. Conductors shall be so arranged that they shall not be subjected to temperatures above those for which they are approved.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.18 Conductor size. Fixture conductors shall not be smaller than No. 18.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.19 Conductor insulation. (1) Fixtures shall be wired with conductors having insulation suitable for the current, voltage, and temperature to which the conductors will be subjected.

(2) Where fixtures are installed in damp, wet, or corrosive locations, conductors shall be of a type approved for such locations.

(3) For current-carrying capacity of fixture wire, see table E 402.04.

(4) For maximum operating temperature and voltage limitation of fixture wires, see section E 310.02.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.20 Conductors for certain conditions. (1) Fixtures provided with Mogul base screw-shell lampholders and operating at not more than 300 volts between conductors shall be wired with type AF, SF-1, SF-2, SFF-1 or SFF-2 fixture wire.

(2) Fixtures provided with other than Mogul base screw-shell lampholders and operating at not more than 300 volts between conductors shall be wired with type AF, SF-1, SF-2, SFF-1, SFF-2 fixture wire or type AFC, AFPO, or AFPD flexible cord.

(a) *Exception No. 1.* Where temperatures do not exceed 90°C. (194°F.), type CF fixture wire or type CFC, CFPD, or CFPO flexible cord may be used.

(b) *Exception No. 2.* Where temperatures exceed 60°C. but are not higher than 75°C., type RH rubber-covered wire, type RFH-1, RFH-2, FFH-1, and FFH-2 fixture wires may be used.

(c) *Exception No. 3.* Where temperatures do not exceed 60°C. (140°F.), type T thermoplastic wire, types TF and TFF fixture wire, type R rubber-covered wire, and types RF-1, RF-2, FF-1, FF-2 fixture wire may be used, including use in fixtures of decorative type on which lamps of not over 60-watt rating are used in connection with imitation candles.

Note: See sections E 402.06 and E 310.02 for fixture wires and conductors; also, table E 400.09 (2) for flexible cords.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.21 Conductors for movable parts. (1) Stranded conductors shall be used on chain fixtures and other movable parts.

(2) Conductors shall be so arranged that the weight of the fixture or movable parts will not put a tension on the conductors.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.22 Pendent conductors for incandescent filament lamps. (1) Pendent lampholders with permanently attached leads, where used in other than festoon wiring, shall be hung from separate stranded rubber-covered conductors which are soldered directly to the circuit conductors but supported independently thereof.

(2) Such pendent conductors shall be not smaller than No. 14 for heavy-duty or medium-base screw-shell lampholders, nor, except for

approved Christmas tree and decorative lighting outfits, smaller than No. 18 for intermediate or candelabra-base lampholders.

(3) Pendent conductors longer than 3 feet shall be twisted together where not cabled in an approved assembly.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.23 Protection of conductors. (1) Conductors shall be secured in a manner that will not tend to cut or abrade the insulation.

(2) Conductors shall be protected from abrasion where they pass through metal.

(3) Exposed flexible cord or fixture wire shall not be used to supply permanently installed fixtures in show cases or wall cases.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.24 Conductor protection at lampholders. Where a metal lampholder is attached to a flexible cord, the inlet shall be equipped with an insulating bushing which, if threaded, shall not be smaller than nominal $\frac{3}{8}$ inch pipe size. The edges of the bushing shall be rounded and all inside fins removed in order to provide a smooth bearing surface for the conductors.

Note: Bushings having holes $\frac{9}{32}$ inch in diameter are suitable for use with plain pendent cord and holes $\frac{13}{32}$ inch in diameter with reinforced cord.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.25 Connections, splices and taps. (1) Fixtures shall be so installed that the connections between the fixture conductors and the circuit conductors may be inspected without requiring the disconnection of any part of the wiring, unless the fixture is connected by means of a plug and receptacle.

(2) Splices and taps shall not be located within fixture arms or stems.

(3) No unnecessary splices or taps shall be made within or on a fixture.

(4) For approved means of making connections, see sections E 195.13 and E 195.14.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.26 Fixture raceways. (1) Fixtures shall not be used as a raceway for circuit conductors, unless the fixtures meet the requirements of approved raceways, except that the conductors of a single branch circuit supplying the fixtures may be carried through an installation of fixtures approved for end to end assembly to form a continuous raceway.

(2) Individual fixtures of all types which are coupled, butted, telescoped, or connected together with metal raceways not over 18 inches in length, shall be considered as a single fixture.

(3) Branch circuit conductors within 3 inches of a ballast shall be type RHH or other types of conductors recognized for use at temperatures of 90° C. or higher.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.27 Polarization of fixtures. Fixtures shall be so wired that the screw-shells of lampholders will be connected to the same fixture or circuit conductor or terminal. For polarity identification of conductors to screw-shells of lampholders, see section E 200.08.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

F. CONSTRUCTION OF FIXTURES

E 410.28 Combustible shades and enclosures. Adequate air space shall be provided between lamps and shades or other enclosures of combustible material.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.29 Fixture rating. (1) All fixtures requiring ballasts or transformers shall be plainly marked with their electrical rating and the manufacturer's name, trade-mark or other suitable means of identification.

(2) The electrical rating shall include the voltage and frequency, and shall indicate the current rating of the unit including the ballast, transformer or auto-transformer.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.30 Design and material. Fixtures shall be constructed of metal, wood, or other approved material and shall be so designed and assembled as to secure requisite mechanical strength and rigidity. Wireways, including the entrances thereto, shall be such that conductors may be drawn in and withdrawn without injury.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.31 Non-metallic fixtures. In all fixtures not made entirely of metal, wireways shall be lined with metal unless approved armored or lead-covered conductors with suitable fittings are used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.32 Mechanical strength. (1) Tubing used for arms and stems where provided with cut threads shall be not less than 0.040 inch in thickness and when provided with rolled (pressed) threads shall be not less than 0.025 inch in thickness. Arms and other parts shall be fastened to prevent turning.

(2) Metal canopies supporting lampholders, shades, etc., exceeding 8 lbs., or incorporating attachment plug receptacles, shall be not less than 0.020 inch in thickness. Other canopies shall be not less than 0.016 inch when made of steel and not less than 0.020 inch when of other metals.

(3) Pull type canopy switches shall not be inserted in the rims of metal canopies which are less than 0.025 inch in thickness unless the rims are reinforced by the turning of a bead or the equivalent. Pull type canopy switches, whether mounted in the rims or elsewhere in sheet metal canopies, shall be located not more than 3½ inches from the center of the canopy. Double set screws, double canopy rings, a screw ring, or equal method shall be used where the canopy supports a pull type switch or pendent receptacle.

Note: The above thickness requirements apply to measurements made on finished (formed) canopies.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.33 Wiring space. Bodies of fixtures, including portable lamps, shall provide ample space for splices and taps and for the installation of devices, if any. Splice compartments shall be of non-absorptive, non-combustible material.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.34 Fixture studs. Fixture studs which are not parts of outlet boxes, hickeyes, tripods, and crowfeet shall be made of steel, malleable iron, or other approved material.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.35 Insulating joints. Insulating joints shall be composed of materials especially approved for the purpose. Those which are not designed to be mounted with screws or bolts shall have a substantial exterior metal casing, insulated from both screw connections.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.36 Portable lamps. Portable table and floor lamps and fan motors on ceiling fixtures may be wired with approved rubber-covered conductors, provided the wiring is not located so as to be subject to undue heating from lamps.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.37 Portable handlamps. Handlamps of the portable type supplied through flexible cords shall be of the molded composition or other type approved for the purpose. Metal-shell paper-lined lampholders shall not be used. Handlamps shall be equipped with a handle. Where subject to physical damage or where lamps may come in contact with combustible material, handlamps shall be equipped with a substantial guard attached to the lampholder or the handle.

Note: For garages, see section E 511.06.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.38 Cord bushings. Bushing or the equivalent shall be provided where flexible cord enters the base or stem of a portable lamp. The bushing shall be of insulating material unless a jacketed type of cord is used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.39 Tests. All wiring shall be free from short-circuits and grounds, and shall be tested for these defects prior to being connected to the circuit.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.40 Live parts. Exposed live parts within porcelain fixtures shall be suitably recessed and so located as to make it improbable that wires will come in contact with them. There shall be a spacing of at least $\frac{1}{2}$ inch between live parts and the mounting plane of the fixture.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

G. INSTALLATION OF LAMP HOLDERS

E 410.41 Screw-shell type. Lampholders of the screw-shell type shall be installed for use as lampholders only.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.42 Double-pole switched lampholders. Where used on unidentified 2-wire circuits tapped from the ungrounded conductors of multi-wire circuits, the switching device of lampholders of the switched type shall simultaneously disconnect both conductors of the circuit. See section E 200.05.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.43 Lampholders in damp or wet locations. Lampholders installed in damp or wet locations shall be of the weatherproof type.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

H. CONSTRUCTION OF LAMPHOLDERS

E 410.44 Insulation. The outer metal shell and the cap shall be lined with insulating material which shall prevent the shell and cap from becoming a part of the circuit. The lining shall not extend beyond the metal shell more than $\frac{1}{8}$ inch, but shall prevent any current-carrying part of the lamp base from being exposed when a lamp is in the lampholding device.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.45 Lead wires. Lead wires, furnished as a part of weatherproof lampholders and intended to be exposed after installation, shall be of approved, stranded, rubber-covered conductors, not less than No. 14 gauge (No. 18 gauge for candelabra sockets), and shall be sealed in place or otherwise made raintight.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.46 Switched lampholders. Switched lampholders shall be of such construction that the switching mechanism interrupts the electrical connection to the center contact. The switching mechanism may also interrupt the electrical connection to the screw shell when connection to the center contact is simultaneously interrupted.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

J. LAMPS

E 410.49 Bases, incandescent lamps. An incandescent lamp for general use on lighting branch circuits shall not be equipped with a medium base when rated over 300 watts, nor with a Mogul base when rated over 1,500 watts. Above 1,500 watts, special approved bases or other devices shall be used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.50 Enclosures, mercury-vapor lamp auxiliary equipment. Resistors or regulators for mercury-vapor lamps shall be enclosed in noncombustible cases and treated as sources of heat.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.51 Arc lamps. Arc lamps used in theatres shall conform to section E 520.61, and arc lamps used in projection machines shall conform to section E 540.20. Arc lamps used on constant-current systems shall conform to the general requirements of chapter E 710.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

K. RECEPTACLES

E 410.52 Rating and type. (1) Receptacles installed for the attachment of portable cords shall be rated at not less than 15 amperes, 125 volts, or 10 amperes, 250 volts, and shall be of a type not suitable for use as lampholders.

(2) **METALLIC FACEPLATES.** Metallic faceplates shall be of ferrous metal not less than 0.030 inch in thickness or of non-ferrous metal not less than 0.040 inch in thickness. Faceplates of insulating material

shall be non-combustible and not less than 0.10 inch in thickness but may be less than 0.10 inch in thickness if formed or reinforced to provide adequate mechanical strength.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.53 Receptacles in floors. Receptacles located in floors shall be enclosed in floor boxes especially approved for the purpose.

(1) **EXCEPTION.** Where such receptacles are located in elevated floors of show-windows or other locations and when the administrative authority judges them to be free from physical damage, moisture and dirt, the standard approved type of flush receptacle box may be used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.54 Receptacles in damp or wet locations. Receptacles installed in damp or wet locations shall be of the weatherproof type.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.55 Receptacles—Grounding type. Receptacles which are installed to provide for an equipment grounding connection for cord-connected equipment for a 2-wire power supply from a receptacle rated 15 amperes maximum at a potential between 151 and 300 volts; or either 15 or 20 amperes at a potential of not more than 150 volts; shall have one separate fixed grounding member. The terminal for connection to the grounding member shall be designated by a green-colored finish.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.56 Attachment plugs (caps)—Grounding type. An attachment plug (cap) for use with a grounding-type receptacle shall, when for use with a grounding type receptacle as described in section E 410.55, have one separate fixed grounding member which shall be so designed as to prevent it from being capable of touching any current-carrying contact of the receptacle. The terminal connection for this grounding member shall be designated by a green-colored finish.

(1) **EXCEPTION:** The grounding contacting member of grounding type attachment plugs on the power supply cord of a hand-held tool or hand-held appliance may be of the movable self-restoring type.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

L. ROSETTES

E 410.57 Approved types. (1) Fusible rosettes shall not be installed.

(2) Separable rosettes which make possible a change in polarity shall not be used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.58 Rosettes in damp and wet locations. Rosettes installed in damp or wet locations shall be of the weatherproof type.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.59 Rating. Rosettes shall be rated at 660 watts, 250 volts, with a maximum current rating of 6 amperes.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.60 Rosettes for exposed wiring. When designed for use with exposed wiring, rosettes shall be provided with bases which shall have at least 2 holes for supporting screws, shall be high enough to keep

the wires and terminals at least $\frac{1}{2}$ inch from the surface wired over, and shall have a porcelain lug under each terminal to prevent the rosette being placed over projections which would reduce the separation to less than $\frac{1}{2}$ inch.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.61 Rosettes for use with boxes or raceways. When designed for use with conduit boxes or wire raceways, rosette bases shall be high enough to keep wires and terminals at least $\frac{3}{8}$ inch from the surface wired over.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

M. SPECIAL PROVISIONS FOR FLUSH AND RECESSED FIXTURES

E 410.62 Approved type. Fixtures which are installed in recessed cavities in walls or ceilings shall be of an approved type and shall conform to sections E 410.63 to E 410.70 inclusive.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.63 Temperature. (1) Fixtures shall be so constructed or installed that adjacent combustible material will not be subjected to temperatures in excess of 90°C. (194°F.).

(2) Where a fixture is recessed in fire-resistant material in a building of fire-resistant construction, a temperature higher than 90°C. (194°F.), but not higher than 150°C. (320°F.) is acceptable if the fixture is plainly marked that it is approved for that service.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.64 Clearance. Recessed portions of enclosures, other than at points of support, shall be spaced at least $\frac{1}{2}$ inch from combustible material.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.65 Wiring. (1) Conductors having insulation suitable for the temperature encountered shall be used.

(2) Fixtures having branch circuit terminal connections which operate at temperatures higher than 60°C. (140°F.) shall have circuit conductors as described in subsections E 410.65 (2) (a) and (2) (b):

(a) Branch circuit conductors having an insulation suitable for the temperature encountered may be run directly to the fixture.

(b) Tap connection conductors having an insulation suitable for the temperature encountered shall be run from the fixture terminal connection to an outlet box placed at least one foot from the fixture. Such a tap shall extend for at least 4 feet but not more than 6 feet and shall be in a suitable metal raceway.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

N. CONSTRUCTION; FLUSH AND RECESSED FIXTURES

E 410.66 Temperature. Fixtures shall be so constructed that adjacent combustible material will not be subject to temperatures in excess of 90°C. (194°F.).

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.67 Enclosure. Sheet metal enclosures shall be protected against corrosion by galvanizing, plating, or other equivalent heat-

resisting coating, and shall not be less than No. 22 MS (USS revised) gauge in thickness.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.68 Lamp wattage marking. Incandescent lamp fixtures shall be marked to indicate the maximum allowable wattage of lamps. The markings shall be permanently installed, in letters at least $\frac{1}{4}$ inch high, and located where visible during relamping.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.69 Solder prohibited. No solder shall be used in the construction of the fixture box.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.70 Lampholders. Lampholders of the screw-shell type shall be of porcelain unless especially approved for the purpose. Cements, where used, shall be of the high-heat type.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

P. SPECIAL PROVISIONS FOR ELECTRIC DISCHARGE LIGHTING SYSTEMS OF 1,000 VOLTS OR LESS

E 410.71 General. (1) Equipment for use with electric discharge lighting systems and designed for an open-circuit voltage of 1,000 volts or less shall be of a type approved for such service.

(2) The terminals of an electric discharge lamp shall be considered as alive where any lamp terminal is connected to a potential of more than 300 volts.

(3) Transformers of the oil-filled type shall not be used.

(4) In addition to complying with the general requirements for lighting fixtures, such equipment shall conform to part P of this chapter.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.72 Direct-current equipment. Fixtures installed on direct-current circuits shall be equipped with auxiliary equipment and resistors especially designed and approved for direct current operation and the fixtures shall be so marked.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.73 Voltages; dwelling occupancies. (1) Equipment having an open-circuit voltage of more than 1,000 volts shall not be installed in dwelling occupancies.

(2) Equipment having an open-circuit voltage of more than 300 volts shall not be installed in dwelling occupancies unless such equipment is so designed that there shall be no exposed live parts when lamps are being inserted, are in place, or are being removed.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.74 Fixture mounting. (1) EXPOSED BALLASTS. Fixtures having exposed ballasts or transformers shall be so installed that such ballasts or transformers shall not be in contact with combustible material.

(2) COMBUSTIBLE LOW-DENSITY CELLULOSE FIBERBOARD. Where a fixture containing a ballast is to be installed on combustible low-density cellulose fiberboard it shall, where surface mounted:

- (a) Be approved for this condition, or
- (b) Be spaced not less than 1½ inches from the surface of the fiberboard.
- (c) Where such fixtures are partially or wholly recessed, the provisions of sections E 410.62 to E 410.70 shall apply.

Note: Combustible low-density cellulose fiberboard is considered to include sheets, panels and tiles which have a density of 20 pounds per cubic foot or less, and which are formed of bonded plant fiber material; but does not include solid or laminated wood, nor fiberboard which has a density in excess of 20 pounds per cubic foot.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.75 Auxiliary equipment not integral with fixture. (1) Auxiliary equipment, including reactors, capacitors, resistors, and similar equipment, where not installed as part of a lighting fixture assembly shall be enclosed in accessible, permanently-installed metal cabinets.

(2) Such separate equipment should be installed close to the lamps to keep the conductors between lamps and auxiliaries as short as possible. Where display cases are not permanently installed, no portion of a secondary circuit may be included in more than a single case.

(3) Ballasts approved for separate mounting and for direct connection to an approved wiring system need not be separately enclosed.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.76 Auto-transformers. An auto-transformer which is used as part of a ballast for supplying lighting units and which raises the voltage to more than 300 volts shall be supplied only by a grounded system.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.77 Switches. Snap switches shall conform to section E 380.14.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

Q. SPECIAL PROVISIONS FOR ELECTRIC DISCHARGE LIGHTING SYSTEMS OF MORE THAN 1,000 VOLTS

E 410.78 General. (1) Equipment for use with electric discharge lighting systems and designed for an open-circuit voltage of more than 1,000 volts shall be of a type approved for such service.

(2) The terminal of an electric discharge lamp shall be considered as alive when any lamp terminal is connected to a potential of more than 300 volts.

(3) In addition to complying with the general requirements for lighting fixtures, such equipment shall conform to sections E 410.78 to E 410.90 inclusive.

Note: For signs and outline lighting, see chapter E 600.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.79 Control. (1) Fixtures or lamp installations shall be controlled either singly or in groups by an externally-operable switch or circuit-breaker which shall open all ungrounded primary conductors.

(2) The switch or circuit-breaker shall be located within sight of the fixtures or lamps, or it may be located elsewhere if it is provided with means for locking in the open position.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.80 Lamp terminals and lampholders. Parts which must be removed for lamp replacement shall be hinged or fastened by an approved means. Lamps or lampholders or both shall be so designed that

there shall be no exposed live parts when lamps are being inserted or are being removed.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.81 Transformer ratings. Transformers and ballasts shall have a secondary open-circuit voltage of not more than 15,000 volts with an allowance on test of 1,000 volts additional. The secondary current rating shall be not more than 120 milliamperes when the open circuit voltage is more than 7,500 volts, and not more than 240 milliamperes when the open circuit voltage is 7,500 volts or less.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.82 Transformer type. Transformers shall be of an approved enclosed type. Transformers of other than the askarel insulated or dry type shall not be used.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.83 Transformer secondary connections. (1) The high-voltage windings of transformers shall not be connected in series or in parallel, except that for two transformers, each having one end of its high-voltage winding grounded and connected to the enclosure, the high-voltage windings may be connected in series to form the equivalent of a mid-point grounded transformer.

(2) The grounded ends shall be connected by an insulated conductor not smaller than No. 14 AWG.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.84 Transformer locations. (1) Transformers shall be accessible after installation.

(2) The transformers shall be installed as near to the lamps as practicable to keep the secondary conductors as short as possible.

(3) Transformers shall be so located that adjacent combustible materials will not be subjected to temperatures in excess of 90°C. (194°F.).

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.85 Transformer loading. The lamps connected to any transformer shall be of such length and characteristics as not to cause a condition of continuous over-voltage on the transformer.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.86 Wiring method: Secondary conductors. Approved gas-tube sign cable suitable for the voltage of the circuit shall be used. For installation of conductors, see section E 600.31.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.87 Lamp supports. Lamps shall be adequately supported as required in section E 600.33.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.88 Exposure to damage. Lamps shall not be located where normally exposed to physical damage.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.89 Marking. Each fixture or each secondary circuit of tubing having an open-circuit voltage of more than 1,000 volts shall have a clearly legible marking in letters not less than ¼ inch high reading "Caution _____ volts". The voltage indicated shall be the rated open-circuit voltage.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.90 Switches. Snap switches shall conform to section E 380.14.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

R. GROUNDING

E 410.91 General. Fixtures and lighting equipment shall be grounded as provided in sections E 410.92 to E 410.96 inclusive.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.92 Metallic wiring systems. Metal fixtures installed on outlets wired with grounded metal raceway or grounded type AC metal-clad cable shall be grounded.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.93 Non-metallic wiring systems. Metal fixtures installed on outlets wired with knob-and-tube work, or non-metallic sheathed cable, on circuits operating at 150 volts or less to ground, shall be grounded.

(1) *Exception No. 1.* Fixtures mounted on metal or metal lath ceilings or walls may be insulated from their supports and from the metal lath by the use of insulating joints or fixture supports and canopy insulators. See section E 410.95.

(2) *Exception No. 2.* Fixtures not mounted on metal or metal-lath ceilings or walls need not be insulated or grounded. See section E 410.95.

Note: Fixtures made of insulating materials, and lampholders with shells of insulating material, are recommended for use with wiring systems that do not afford a ready means for grounding the exposed non-current-carrying parts of fixtures and lampholders.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.94 Equipment of more than 150 volts to ground. (1) Metal fixtures, transformers and transformer enclosures on circuits operating at more than 150 volts to ground shall be grounded.

(2) Other exposed metal parts shall be grounded unless they are insulated from ground and other conducting surfaces and are inaccessible to unqualified persons, except that lamp tie wires, mounting screws, clips and decorative bands on glass lamps spaced not less than 1½ inches from lamp terminals need not be grounded.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.95 Equipment near grounded surfaces. (1) Ungrounded metal lighting fixtures, lampholders and face plates shall not be installed in contact with conducting surfaces nor within 8 feet vertically or 5 feet horizontally of laundry tubs, bath tubs, shower baths, plumbing fixtures, steam pipes or other grounded metal work or grounded surfaces.

(2) Metal pull chains used at these locations shall be provided with insulating links.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.

E 410.96 Methods of grounding. Equipment shall be considered as grounded where mechanically connected in a permanent and effective manner to metal raceway, the armor of type AC metal-clad cable, the grounding conductor in non-metallic sheathed cable, or to a separate grounding conductor not smaller than No. 14, provided that the raceway, armor, or grounding conductor is grounded in a manner specified in chapter E 250.

History: Cr. Register, April, 1964, No. 100, eff. 5-1-64.