

Chapter E 210

BRANCH CIRCUITS

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E 210.01. Scope. The provisions of this chapter shall apply to branch circuits supplying lighting or appliance loads or combinations of such loads. Where motors, or motor-operated appliances, are connected to any circuit supplying lighting or other appliance loads, the provisions of both this chapter and chapter E 430 shall apply. Chapter E 430 shall apply where branch circuit supplies only motor loads.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.02 Specific purpose branch circuit. The provisions applying to branch circuits referred to in the following table are exceptions to the provisions of this chapter or are supplementary thereto, and shall apply to branch circuits supplying the loads referred to therein:

Busways	Section E 364.08
Cranes and Hoists	Section E 610.42
Elevators, Dumbwaiters and Escalators	Section E 620.61
Infra-red Industrial Heating Equipment	Section E 422.11
Inductive and Dielectric Heat Generating Equipment	Chapter E 665
Instruments	Section E 384.22
Motion Picture Studios and Similar Locations	Chapter E 530
Motors and Motor Controllers	Chapter E 430
Organs	Section E 650.06
Remote-Control, Low-Energy Power, Low-Voltage Power and Signal Circuits	Chapter E 725
Signs and Outline Lighting	Section E 600.06
Sound Recording and Reproduction	Section E 640.06
Space Heating; Panel and Embedded Types	Chapter E 422
Systems over 600 Volts	Chapter E 710
Systems under 50 Volts	Chapter E 720
Theatres and Assembly Halls	Sections E 520.41, E 520.52 and E 520.62
Welders	Chapter E 630
X-ray Equipment	Section E 660.03

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.03 Classifications. Branch circuits recognized by this chapter shall be classified in accordance with the maximum permitted rating or setting of the overcurrent device, and the classification for other than

individual branch circuits shall be 15, 20, 30 and 50 amperes. When conductors of higher capacity are used for any reason, the rating or setting of the specified overcurrent device shall determine the circuit classification.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

A. GENERAL PROVISIONS

E 210.04 Multi-wire branch circuits. Branch circuits recognized by this chapter may be installed as multi-wire circuits. A multi-wire branch circuit as referred to herein is a circuit consisting of 2 or more ungrounded conductors having a potential difference between them, and an identified grounded conductor having equal potential difference between it and each ungrounded conductor of the circuit and which is connected to the neutral conductor of the system.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.05 Color code. (1) Where installed in raceways, as open work, or as concealed knob-and-tube work, the conductors of multi-wire branch circuits and 2-wire branch circuits connected to the same system shall conform to the following color code. Three-wire circuits—one black, one white, one red; 4-wire circuits—one black, one white, one red, one blue; 5-wire circuits—one black, one white, one red, one blue, one yellow. When more than one multi-wire branch circuit is carried through a single raceway the ungrounded conductors of the additional circuit may be of colors other than those specified. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.

(2) Any conductor intended solely for equipment grounding purposes shall be identified by a green color unless it be bare. Except for public highway traffic, control, communications, metering, railway, and railroad signal installations, conductors having a green covering shall not be used for other than grounding purposes.

Note: See section E 200.07 for use of white or natural gray for grounded or neutral conductors.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.06 Voltage. (1) The voltage to ground on branch circuits supplying lampholders, fixtures, or standard receptacles of 15-ampere or less rating shall not exceed 150 volts, except as follows:

(a) *Exception No. 1.* In industrial establishments the voltage of branch circuits which supply only lighting fixtures that are equipped with mogul-base screw-shell lampholders or with lampholders of other types approved for the application, mounted not less than 8 feet from the floor, which do not have switch control as an integral part of the fixture shall not exceed 300 volts to ground;

(b) *Exception No. 2.* In industrial establishments, office buildings, schools, stores, and public and commercial areas of other buildings, such as hotels or transportation terminals, the voltage of branch circuits which supply only the ballasts for electric discharge lamps in permanently installed fixtures mounted not less than 8 feet from the floor, which do not have manual switch control as an integral part of the fixture shall not exceed 300 volts to ground;

(c) *Exception No. 3.* For infra-red industrial heating appliances as described in section E 422.11;

(d) *Exception No. 4.* In railway properties as described in section E 195.18.

(2) **VOLTAGE BETWEEN CONDUCTORS—DWELLINGS.** In dwelling occupancies, the voltage between conductors supplying lampholders of the screw-shell type, receptacles, or appliances, shall not exceed 150 volts, except as follows: Exception: The voltage between conductors may exceed 150 volts when supplying only:

(a) Permanently connected appliances,

(b) Portable appliances of more than 1,380 watts,

(c) Portable motor-operated appliances of $\frac{1}{4}$ horsepower or greater rating.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.07 Grounding receptacles. Where a grounding receptacle is installed as specified in subsection E 210.22 (2) and section E 250.059, to provide grounding facilities required in section E 250.045, the branch circuit or branch circuit raceway shall include or provide a grounding conductor to which the grounding contacts of the grounding receptacle shall be connected. The metal armor of armored cable or a metallic raceway is acceptable as a grounding conductor.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.08 Heavy-duty lampholders. Heavy-duty lampholders referred to in this chapter shall include lampholders rated at not less than 750 watts.

(1) **EXCEPTION:** Admedium lampholders rated at 660 watts shall be considered to be heavy duty type.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

B. SPECIFIC REQUIREMENTS

E 210.19 Conductors. Circuit conductors shall conform to the following:

(1) **CARRYING CAPACITY.** Shall have a carrying capacity of not less than the rating of the branch circuit and not less than the maximum load to be served.

(2) **MINIMUM SIZE.** Shall not be smaller than No. 8 for ranges of $8\frac{3}{4}$ kw or more rating, nor smaller than No. 14 for other loads.

(3) **EXCEPTIONS: *Exception No. 1. Range Loads.*** See note 5 of table E 220.05. Where the maximum demand of a range of $8\frac{3}{4}$ kw or more rating is computed according to column A of table E 220.05, the neutral conductor of a 3-wire branch circuit supplying a household electric range, a wall-mounted oven or a counter-mounted cooking unit may be smaller than the ungrounded conductors but shall have a carrying capacity at least 70% of the current-carrying capacity of the ungrounded conductors and shall not be smaller than No. 10.

Note: Cable assemblies with the neutral conductor smaller than the ungrounded conductor shall be so marked.

(b) *Exception No. 2. Tap conductors.* Tap conductors may be of less capacity than the branch circuit rating provided no tap conductor

is of less capacity than the load to be served and provided the rating is not less than 20 amperes for 50 ampere circuits or 15 amperes for circuits rated less than 50 amperes and only where these tap conductors supply either:

1. Individual lampholders or fixtures with taps extending not longer than 18 inches beyond any portion of the lampholder or fixture, except as required in subsection E 410.65 (2) (b); or,
2. Individual outlets with taps not over 18 inches long; or,
3. Infra-red lamp industrial heating appliances,
4. Tap conductors supplying electric ranges, wall-mounted electric ovens and counter-mounted electric cooking units from 50 ampere branch circuits shall be no longer than necessary for servicing.

(c) *Exception No. 3. Fixture wires and cords.* Fixture wires and cords may be of smaller size, but not less than the size specified in exception No. 3 of section E 240.05. See tables subsection E 400.09 (2) and section E 402.04.

(d) *Exception No. 4. Outlet devices.* Outlet devices may have less carrying capacity than the branch circuit rating, but not less than the types and ratings specified in subsections E 210.21 (1)-(3).

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.20 Overcurrent protection. The rating or setting of overcurrent devices shall conform to the following:

(1) **RATING.** Shall not be in excess of the carrying capacity of the circuit conductor.

(a) *Exception: Tap conductors and fixture wires.* Tap conductors, fixture wires and cords as permitted in subsection E 210.19 (3) may be considered as protected by the circuit overcurrent device.

(2) **SINGLE APPLIANCE.** Shall not exceed 150% of the rating of the appliance, where the circuit supplies only a single appliance of 10-ampere or more rating.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.21 Outlet devices. Outlet devices shall have a rating not less than the load to be served and shall conform to the following:

(1) **LAMP HOLDERS.** Lampholders when connected to circuits having a rating of over 20 amperes shall be of the heavy duty type.

(2) **RECEPTACLES.** (a) When connected to circuits having 2 or more outlets, receptacles shall conform to the following:

15-amp. circuits	-----	Not over 15-amp. rating
20-amp. circuits	-----	15 or 20-amp. rating
30-amp. circuits	-----	30-amp. rating
50-amp. circuits	-----	50-amp. rating

(b) Receptacles connected to circuits having different voltages, frequencies or types of current (AC or DC) on the same premises shall be of such design that attachment plugs used on such circuits are not interchangeable.

(c) Grounding receptacles rated at 15 or 20 amperes and installed in circuits of less than 150 volts between conductors shall be approved for use only on potentials less than 150 volts. Grounding receptacles

rated at 15 amperes and installed in circuits of 151 to 300 volts between conductors shall be approved for use only on potentials not less than 151 volts.

(d) Receptacles rated at 15 amperes connected to 15 or 20 ampere branch circuits serving 2 or more outlets shall not supply a total load in excess of 12 amperes for portable appliances.

(3) **CAPACITY OF RANGE RECEPTACLES.** Capacity of range receptacles may be based on single range loads as computed from table E 220.05.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.22 Receptacle outlets required. Receptacle outlets shall be installed as follows:

(1) **GENERAL.** Where portable cords are used, except where the attachment of cords by other means is specifically permitted.

Note: A cord connector that is supported by a permanently connected cord pendant is considered a receptacle outlet.

(2) **DWELLING TYPE OCCUPANCIES.** (a) In every kitchen, dining room, breakfast room, living room, parlor, library, den, sun room, recreation room and bedroom, receptacle outlets shall be installed so that no point along the floor line in any usable wall space is more than 6 feet, measured horizontally, from an outlet in that space including any usable wall space 2 feet wide or greater and the wall space occupied by sliding panels in exterior walls. The receptacle outlets shall, insofar as practicable, be spaced equal distances apart. Receptacle outlets in floor shall not be counted as part of the required number of receptacle outlets unless located close to the wall.

(b) Only grounding type outlets shall be installed in kitchens, laundry rooms, open porches, breezeways, basements, cellars, work shops, garages, on the exterior surfaces of outside walls or in like locations where the outlet may supply equipment used by persons standing on the ground or on grounded conductive materials. These outlets shall be installed in accordance with section E 210.07.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.23. Maximum load. The maximum load shall conform to the following: (1) **MOTOR-OPERATED APPLIANCES.** The total load shall not exceed 80% of the branch circuit rating if motor-operated appliances are supplied. Where circuit supplies only motor-operated appliance loads, chapter E 430 is to apply.

(2) **OTHER LOADS.** The total load shall not exceed the branch circuit rating, and shall not exceed 80% of the rating where in normal operation the load will continue for long periods such as store lighting and similar loads. In computing the load of lighting units which employ ballasts, transformers or auto-transformers, the load shall be based on the total of the ampere rating of such units and not on the wattage of the lamps.

(a) *Exception:* Range loads. See note 5 of table E 220.05.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.24 Permissible loads. Individual branch circuits may supply any loads. Branch circuits having 2 or more outlets may supply only loads as follows:

(1) 15- AND 20-AMPERE BRANCH CIRCUITS. Lighting units and/or appliances. The rating of any one portable appliance shall not exceed 80% of the branch circuit rating. The total rating of fixed appliances shall not exceed 50% of the branch circuit rating when lighting units or portable appliances are also supplied.

(2) 30-AMPERE BRANCH CIRCUITS. Fixed lighting units with heavy duty lampholders in other than dwelling occupancies; or appliances in any occupancy. The rating of any one portable appliance shall not exceed 24 amperes.

(3) 50-AMPERE BRANCH CIRCUITS. Fixed lighting units with heavy duty lampholders in other than dwelling occupancies; or fixed cooking appliances; or fixed range and water heater; or infra-red lamp industrial heating appliances.

Note: The term "fixed" as used in this section recognizes cord connections where otherwise permitted.

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.

E 210.25 Table of requirements. The requirements for circuits having 2 or more outlets (other than the receptacle circuits of subsection E 220.03 (2)) as specifically provided for above are summarized in table E 210.25.

TABLE E 210.25

BRANCH CIRCUIT REQUIREMENTS

(Type R, RW, RU, RUW, RH-RW, SA, T, TW, RH, RUH, RHW, RHH and THW conductors in raceway or cable)

CIRCUIT RATING	15 Amp.	20 Amp.	30 Amp.	50 Amp.
CONDUCTORS: (Min. Size)				
Circuit Wires.....	14	12	10	6
Taps.....	14	14	14	12
Fixture Wires and Cords	Refer to Rule E 240.05, Exception No. 3			
OVERCURRENT PROTECTION	15 Amp.	20 Amp.	30 Amp.	50 Amp.
OUTLET DEVICES:				
Lampholders Permitted	Any Type	Any Type	Heavy Duty	Heavy Duty
Receptacle Rating.....	15 Max. Amp.	15 or 20 Amp.	30 Amp.	50 Amp.
MAXIMUM LOAD	15 Amp.	20 Amp.	30 Amp.	50 Amp.
PERMISSIBLE LOAD	Refer to Rule E 210.24(1)	Refer to Rule E 210.24(1)	Refer to Rule E 210.24(2)	Refer to Rule E 210.24(3)

History: Cr. Register, November, 1961, No. 71, eff. 12-1-61.