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ARTICLE 210 - BRANCH CIRCUITS

210-1. Scope. The provisions of this Article 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 the Article and Article 430 shall apply. Article 430 shall apply where branch circuit supplies only motor loads.

210-2. Specific Purpose Branch Circuit. The provisions applying to branch circuits referred to in the following list are exceptions to the provisions of this Article or are supplementary thereto, and shall apply to branch circuits supplying the loads referred to therein:

Boat Harbor Wiring	Section 555-2
Busways	Section 364-8
Cranes and Hoists	Section 610-42
Data Processing Systems	Section 645-2
Elevators, Dumbwaiters and Escalators	Section 620-61
Fixed Electric Space Heating Equipment	Section 424-3
Infrared Industrial Heating Equipment	Section 422-15, 424-3
Inductive and Dielectric Heat Generating Equipment	Article 665
Instruments	Section 384-22
Motion Picture Studios and Similar Locations	Article 530
Motors and Motor Controllers	Article 430
Organs	Section 650-6
Remote-Control, Low-Energy Power, Low- Voltage Power and Signal Circuits	Article 725
Signs and Outline Lighting	Section 600-6
Sound Recording and Reproduction	Section 640-6
Systems over 600 Volts	Article 710
Systems under 50 Volts	Article 720
Theaters Theaters and Assembly Halls	Section 520-41, 520- 52
	and 520- 62
Welders	Article 630

210-3. Classifications. Branch circuits recognized by this Article 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, 40 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.

A. General Provisions

210-4. Multiwire Branch Circuits. Branch circuits recognized by this Article may be installed as multiwire circuits. See Article 100 for Definition.

210-5. Color Code. Where installed in raceways, as aluminum sheathed cable, as open work, or as concealed knob-and-tube work, the conductors of multiwire branch circuits and two-wire branch circuits connected to the same system shall conform to the following color code. Three-wire circuits - one black, one white, one red; four-wire circuits - one black, one white, one red, one blue; five-wire circuits - one black, one white, one red, one blue, one yellow. Where more than one multiwire 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.

Any conductor intended solely for grounding purposes shall be identified by a continuous green color or a continuous green color with one or more yellow stripes unless it be bare. Branch circuit conductors and equipment lead wires to which branch circuit conductors attach 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 above is not intended to prohibit the use of a conductor having a continuous green color or a continuous green color with one or more yellow stripes as insulation for internal wiring of equipment, except when such wiring serves as the lead wires to which the branch circuit conductors attach.

See Section 200-7 for use of white or natural gray for grounded or neutral conductors.

210-6. Voltage.

(a) Voltage to Ground. 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:

Exception No. 1. In industrial establishments or in stores where the conditions of maintenance and supervision assure that only competent individuals will service the lighting fixtures 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 eight feet from the floor, which do not have switch control as an integral part of the fixture shall not exceed 300 volts to ground.

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 mounted in permanently installed fixtures, by other than screw-shell type lampholders, which do not have manual switch control as integral part of the fixture shall not exceed 300 volts to ground. Where screw-shell type lampholders are used for electric discharge lamps the fixtures shall be installed not less than eight feet from the floor.

Exception No. 3. No infrared industrial heating appliances as described in Section 422-15.

Exception No. 4. In railway properties as described in Section 110-19;

Exception No. 5. The branch circuits supplying the ballasts for electric discharge lamps mounted in permanently installed fixtures on pole for the illumination of areas such as highways, bridges, athletic fields, parking lots, at a height not less than 22 feet, or on other structures such as tunnels at a height not less than 18 feet, shall not exceed 500 volts between conductors when installed as provided in Section 730-7(a).

(b) 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:

- (1) Permanently connected appliances,
- (2) Portable appliances of more than 1,380 watts,
- (3) Portable motor-operated appliances of 1/4 horsepower or greater rating.

(c) Voltage Drop. The size of the conductors for branch circuits as defined in Article 100 should be such that the voltage drop would not exceed 3 per cent to the farthest outlet for power, heating, lighting, or combinations thereof. Providing further

that the maximum total voltage drop for feeders, and branch circuits should not exceed 5 per cent over all.

210-7. Grounding Receptacles. Receptacles and cord connectors equipped with grounding contacts shall have those contacts effectively grounded. The branch circuit or branch circuit raceway shall include or provide a grounding conductor to which the grounding contacts of the receptacle or cord connector shall be connected. The armor of type AC metal-clad cable, the sheath of MI and ALS cables, or a metallic raceway is acceptable as a grounding conductor. See Sections 210-21(b), 250-45, 250-57(a), 250-59 and 350-5.

Exception: For extensions only in existing installations which do not have a grounding conductor in the branch circuit, the grounding conductor of a grounding type receptacle outlet may be grounded to a grounded cold water pipe near the equipment.

210-8. Heavy-Duty Lampholders. Heavy-duty lampholders referred to in this Article shall include lampholders rated at not less than 750 watts.

Exception: Admedium lampholders rated at 660 watts shall be considered to be heavy duty type.

B. Specific Requirements

210-19. Conductors. Circuit conductors shall conform to the following:

(a) **Ampacity.** Shall have an ampacity of not less than the rating of the branch circuit and not less than the maximum load to be served.

(b) **Minimum Size.** Shall not be smaller than No. 8 for ranges of 8-3/4 kw or more rating, nor smaller than No. 14 for other loads.

(c) **Exceptions:**

Exception No. 1. Range Loads. See Note 5 of Table 220-5. Where the maximum demand of a range of 8-3/4 kw or more rating is computed according to Column A of Table 220-5, the neutral conductor of a three-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 an ampacity at least 70 per cent of the ampacity of the ungrounded conductors and shall not be smaller than No. 10.

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

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 40 or 50 ampere circuits or 15 amperes for circuits rated less than 40 amperes and only when these tap conductors supply either:

(a) Individual lampholders or fixtures with taps extending not longer than 18 inches beyond any portion of the lampholder or fixture, except as required in Section 410-65 (b-2); or,

(b) Individual outlets with taps not over 18 inches long; or,

(c) Infra-red lamp industrial heating appliances.

(d) Nonheating leads of snow and ice melting cables and mats.

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 240-5(a).

See Tables 400-9(b) and 402-4.

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 Sections 210-21(a-c).

Exception No. 5. Where tap conductors supply electric ranges, wall-mounted electric ovens and counter-mounted electric cooking units from 50 ampere branch circuits they shall be of suitable capacity for the load to be served, not less than 20 amperes in rating and no longer than necessary for servicing the appliance.

210-20. Overcurrent Protection. The rating or setting of overcurrent devices shall conform to the following:

(a) Rating. Shall not be in excess of the value specified in Section 240-5.

Exception: Tap Conductors and Fixture Wires. Tap conductors, fixture wire and cords as permitted in Section 210-19(c) may be considered as protected by the circuit overcurrent device.

(b) Single Appliance. Shall not exceed 150 per cent of the rating of the appliance, where the circuit supplies only a single appliance of 10-ampere or more rating.

(c) Continuous Loads. Where loads other than motor loads will constitute continuous loads see Sections 210-23(b), 220-2 & 240-2.

210-21. Outlet Devices. Outlet devices shall have a rating not less than the load to be served and shall conform to the following:

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

(b) **Receptacles.** Receptacles installed on 15 ampere and 20 ampere branch-circuits shall be of the grounding type and they shall be installed in accordance with Section 210-7. Grounding type receptacles which are of a type that rejects non-grounding type attachment plugs or which are of the locking type may be used for specific purposes or in special locations.

A single receptacle installed on an individual branch circuit shall have a rating of not less than the rating of the branch circuit.

When grounding type receptacles are used as replacements for existing non-grounding types of grounding conductor installed in accordance with Section 250-57 shall be provided. If it is impractical to reach a source of ground a non-grounding type receptacle shall be used. The installation of grounding type outlets shall not be used as a requirement that all portable equipment be of the grounded type. See Article 250 for requirements for the grounding of portables.

Receptacles required in Section 517-3(d) are considered as meeting the requirements of this Section.

When connected to circuits having two 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
40-amp. circuits	.....	40 or 50-amp. rating
50-amp. circuits	.....	50-amp. rating

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.

Grounding type receptacles shall be installed only on circuits of the voltage class and current for which they have been approved.

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

Receptacles rated at 20 amperes connected to 20 ampere branch circuits serving two or more outlets shall not supply a total load in excess of 16 amperes for portable appliances.

(c) Capacity of range receptacles may be based on single range loads as computed from Table 220-5.

210-22. Receptacle Outlets Required. Receptacle outlets shall be installed as follows:

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

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

(b) **Dwelling Type Occupancies.** In every kitchen, family room, 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 wall space is more than six feet, measured horizontally, from an outlet in that space including any wall space two 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. At least one outlet shall be installed for the laundry.

Outlets in other sections of the dwelling for special appliances such as laundry equipment, shall be placed within 6 feet of the intended location of the appliance.

Exception No. 1. A dwelling unit that is an apartment or living area in a multi-family building where laundry facilities are provided on the premises that are available to all building occupants need not be provided with a laundry receptacle.

Exception No. 2. In other than single family dwellings where laundry facilities are not to be installed or permitted, a laundry receptacle need not be provided.

Exception No. 3. A dwelling that is a unit in a hotel, motel, motor court, or motor hotel, need not be provided with a laundry receptacle.

(c) **Guest rooms in Hotels, Motels, and Similar Occupancies.** These shall have receptacles installed in accordance with Section 210-22(b).

210-23. Maximum Load. The maximum load shall conform to the following:

(a) Appliances Consisting of Motors and Other Loads. Where a circuit supplies only motor operated appliance loads, Article 430 shall apply. For other than a portable appliance, the branch circuit size shall be calculated on the basis of 125 per cent of motor load where the motor is larger than 1/8 hp plus the sum of the other loads.

(b) Other Loads. The total load shall not exceed the branch circuit rating, and shall not exceed 80 per cent of the rating when load will constitute a continuous load 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.

Exception No. 1. When the assembly including the overcurrent device protecting the branch circuit is approved for continuous operation at 100 per cent of its rating, the total load may equal the branch circuit rating.

Exception No. 2. Where branch circuits are derated in accordance with Note 8 of Tables 310-12 through 310-15 the derating factor for continuous loading shall not apply.

Exception No. 3. Range Loads. See Note 5 of Table 220-5.

210-24. Permissible Loads. Individual branch circuits may supply any loads.

Branch circuits having two or more outlets may supply only loads as follows:

(a) 15- and 20-Ampere Branch Circuits. Lighting units and/or appliances. The rating of any one portable appliance shall not exceed 80 per cent of the branch circuit rating. The total rating of fixed appliances shall not exceed 50 per cent of the branch circuit rating when lighting units or portable appliances are also supplied. Small appliance branch circuits shall supply only the loads stipulated in Section 220-3(b).

(b) 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.

(c) 40-Ampere Branch Circuits. Fixed lighting units with heavy duty lampholders in other than dwelling occupancies; or fixed cooking appliances; or infra-red heating units.

(d) 50-Ampere Branch Circuits. Fixed lighting units with heavy duty lampholders in other than dwelling occupancies; or fixed cooking appliances; or infra-red heating units.

The term "fixed" as used in this Section recognizes cord connections where otherwise permitted.

Fixed outdoor electric snow melting and deicing installations may be supplied by any of the branch circuits described herein provided the circuit supplies no other load.

210-25. Table of Requirements. The requirements for circuits having two or more outlets [other than the receptacle circuits of Section 220-3(b)] as specifically provided for above are summarized in Table 210-25.

**Table 210-25
Branch Circuit Requirements**

(Type FEP, FEPB, RUW, SA, T, TW, RH, RUH, RHW, RHH, THHN, THW, THWN, and XHHW conductors in raceway or cable.)

CIRCUIT RATING	15 Amp.	20 Amp.	30 Amp.	40 Amp.	50 Amp.
CONDUCTORS:					
(Min. Size)					
Circuit Wires*	14	12	10	8	6
Taps	14	14	14	12	12
Fixture Wires and Cords	Refer to Section 240-5(a), Exception No. 3				
OVERCURRENT PROTECTION					
Lampholders Permitted	Any Type	Any Type	Heavy Duty	Heavy Duty	Heavy Duty
Receptacle Rating	15 Max. Amp.	15 or 20 Amp.	30 Amp.	40 or 50 Amp.	50 Amp.
MAXIMUM LOAD					
PERMISSIBLE LOAD	Refer to Section 210-24(a)	Refer to Section 210-24(a)	Refer to Section 210-24(b)	Refer to Section 210-24(c)	Refer to Section 210-24(d)

*These ampacities are for copper conductors where derating is not required. See Tables 310-12 through 310-15.