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ARTICLE 240 - OVERCURRENT PROTECTION

A. Installation

240.1. Scope. This Article provides the general requirements for the application of overcurrent protective devices.

240-2. Purpose of Overcurrent Protection. Overcurrent protection for conductors and equipment is provided for the purpose of opening the electric circuit if the current reaches a value which will cause an excessive or dangerous temperature in the conductor or conductor insulation.

240-3. Protection of Equipment. Equipment shall be protected against overcurrent as specified in the references in the following list:

Equipment	Article No.
Appliances	422
Capacitors	460
Cranes and Hoists	610
Elevators, Dumbwaiters and Escalators	620
Emergency Systems	700
Fixed Electric Space Heating Equipment	424
Generators	445
Inductive and Dielectric Heat Generating Equipment ...	665
Machine Tools	670
Motion Picture Studios and Similar Locations	530
Motors	430
Organs	650
Over 600 Volts	710
Remote-Control Low-Energy Power, Low-Voltage Power and Signal Circuits	725
Services	230
Signs and Outline Lighting	600
Sound Equipment	640
Switchboards and Panelboards	384
Theaters and Assembly Halls	520
Transformers	450
Welders	630

240-4. Time-Delay Overcurrent Devices. Circuit breakers and plug fuses installed in residential occupancies on circuits of 20 amperes or less shall be of the time-delay type.

240-5. Overcurrent Protection.

(a) Conductors. Conductors shall be protected in accordance with their ampacities, as given in Tables 310-12 through 310-15, except as follows:

Exception No. 1. Rating of Nonadjustable Overcurrent Protection of 800 Amperes or Less. Where the standard ampere ratings of fuses and nonadjustable circuit breakers do not correspond with the allowable ampacities of conductors, the next higher standard rating may be used, only where the rating is 800 amperes or less.

Exception No. 2. Adjustable-Trip Circuit Breakers. Adjustable-trip circuit breakers of the thermal trip, magnetic time-delay trip or instantaneous-trip types shall be set to operate at not more than 125 per cent of the allowable ampacity of the conductors.

The effect of the temperature on the operating of thermally controlled circuit breakers should be taken into consideration in the application of such circuit breakers when they are subjected to extremely low or extremely high temperatures.

Exception No. 3. Fixture Wires and Cords. Fixture wire or flexible cord, Size No. 16 or No. 18, and tinsel cord shall be considered as protected by 20 ampere overcurrent devices except as provided in Section 620-61. Fixture wires of the sizes permitted for taps in Section 210-19 (c-2) shall be considered as protected by the overcurrent device of the branch circuit of Article 210 when conforming to the following:

- 20 ampere circuits, No. 18 cord and larger.
- 30 ampere circuits, cord of 10 amperes capacity and over.
- 40 ampere circuits, cord of 20 amperes capacity and over.
- 50 ampere circuits, cord of 20 amperes capacity and over.

Exception No. 4. Motor Circuits. The conductors supplying motors and motor-operated appliances shall be considered as protected by the overcurrent protective devices specified in Sections 530-32, 430-34, 430-52, 430-53, 430-62.

Exception No. 5. Remote Control. Except as provided in Article 725, the conductors of the control circuits of remote-control switches shall be considered as protected from overcurrent by overcurrent devices that are not of the so-called time-lag type and are rated or set at not more than 500 per cent of the ampacity

of the remote-control conductors, as specified in Tables 310-12 through 310-15.

(b) Standard Ratings. Standard ampere ratings for fuses and nonadjustable circuit breakers are 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350, 400, 450, 500, 600, 700, 800, 1000, 1200, 1600, 2000, 2500, 3000, 4000, 5000, and 6000.

240-6. Fuses.

(a) Plug fuses and fuseholders shall not be used in circuits exceeding 125 volts between conductors except in circuits supplied from a system having a grounded neutral and no conductor in such circuits operating at more than 150 volts to ground.

(b) Cartridge fuses and fuseholders rated at 300 volts shall not be used in circuits exceeding 300 volts between conductors except in circuits supplied from a system having a grounded neutral and no conductor in such circuits operating at more than 300 volts to ground.

(c) The screw-shell of plug-type fuseholders shall be connected to the load side of the circuit.

240-8. Thermal Devices. Thermal cutouts, thermal relays and other devices not designed to open short-circuits, shall not be used for protection of conductors against overcurrent due to short-circuits or grounds but may be used to protect motor branch circuit conductors from overload if protected in accordance with Section 430-40.

240-9. Feeders at Supply Stations. Each conductor of a constant-potential circuit entering or leaving a supply station, except grounded neutral conductors, shall be protected from excessive current by a circuit breaker, or by an equivalent device of approved design. Such protective devices shall be located as near as practicable to the point where the conductors enter or leave the building. For the outgoing circuits not connected with other sources of power, the protective devices may be placed on the supply side of transformers or similar devices.

240-11. Ungrounded Conductors.

(a) An overcurrent device (fuse or overcurrent trip unit of a circuit breaker) shall be placed in each ungrounded conductor. For motor circuits see Article 430.

(b) Circuit breakers shall open all ungrounded conductors of the circuit, except as follows:

Exception: Individual single-pole circuit breakers may be used for the protection of each conductor of ungrounded 2-wire circuits, each ungrounded conductor of 3-wire direct-current or single-phase circuits, or for each ungrounded conductor of lighting or appliance branch circuits connected to 4-wire three-phase systems or 5-wire 2-phase systems, provided such lighting or appliance circuits are supplied from a system having a grounded neutral and no conductor in such circuits operates at a voltage greater than permitted in Section 210-6.

240-12. Grounded Conductor. No overcurrent device shall be placed in any permanently grounded conductor, except as follows:

Exception No. 1. Where the overcurrent device simultaneously opens all conductors of the circuit.

Exception No. 2. For motor-running protection as provided in Sections 430-36 and 430-37.

240-13. Change in Size of Grounded Conductor. Where a change occurs in the size of the ungrounded conductor, a similar change may be made in the size of the grounded conductor.

240-14. Fuses or Circuit Breakers in Parallel. Overcurrent devices consisting of fuses and/or circuit breakers shall not be arranged or installed in parallel.

Exception: Circuit breakers assembled in parallel which are tested and approved as a single unit.

B. Location

240-15. Location in Circuit. Overcurrent devices shall be located at the point where the conductor to be protected receives its supply, except as follows:

Exception No. 1. Service Conductors. An overcurrent protective device for service conductors may be located as specified in Section 230-91.

Exception No. 2. Smaller Conductor Protected. Where the overcurrent device protecting the larger conductors also protects the smaller conductors in accordance with Tables 310-12 through 310-15.

Exception No. 3. Branch Circuits. Taps to individual outlets and circuit conductors supplying a single household electric range shall be considered as protected by the branch circuit overcurrent devices when in accordance with the requirements of Sections 210-19, 210-20 and 210-25.

Exception No. 4. Feeder Taps. A conductor tapped from a feeder shall be considered as properly protected from overcurrent when installed in accordance with Sections 364-8 and 430-59.

Exception No. 5. Feeder Taps Not Over 10 Feet Long. Where (1) the smaller conductor has an ampacity of not less than the sum of the allowable ampacities for the conductors of the one or more circuits or loads supplied, and (2) the tap is not over 10 feet long and does not extend beyond the switchboard, panelboard, or control devices which it supplied, and (3) except at the point of connection to the feeder, the tap is enclosed in conduit, electrical metallic tubing, or in metal gutters when not a part of the switchboard or panelboard.

Exception No. 6. Feeder Taps Not Over 25 Feet Long. Where the smaller conductor has an ampacity at least one-third that of the conductor from which it is supplied, and provided the tap is suitably protected from physical damage, is not over 25 feet long, and terminates in a single circuit breaker or set of fuses which will limit the load on the tap to that allowed by Tables 310-12 through 310-15. Beyond this point the conductors may supply any number of circuit breakers or sets of fuses.

240-16. Location in Premises. Overcurrent devices shall be located where they will be:

(a) Readily accessible, except as provided in Sections 230-91 and 230-92 for service equipment and Section 364-11 for busways.

(b) Not exposed to physical damage.

(c) Not in the vicinity of easily ignitable material.

C. Enclosures

240-17. Enclosures for Overcurrent Devices.

(a) **General.** Overcurrent devices shall be enclosed in cutout boxes or cabinets, unless a part of a specially approved assembly which affords equivalent protection, or unless mounted on switchboards, panelboards or controllers located in rooms or enclosures free from easily ignitable material and dampness. The operating handle of a circuit breaker may be accessible without opening a door or cover.

(b) **Damp or Wet Locations.** Enclosures for overcurrent devices in damp or wet locations shall be of a type approved for such locations and shall be mounted so there is at least one-fourth inch air space between the enclosure and the wall or other supporting surface.

(c) **Vertical Position.** Enclosures for overcurrent devices shall be mounted in a vertical position unless in individual instances this is shown to be impracticable.

(d) **Rosettes.** Fuses shall not be mounted in rosettes.

D. Disconnecting and Guarding

240-18. Disconnection of Fuses and Thermal Cutouts Before Handling. Disconnecting means shall be provided on the supply side of all fuses or thermal cutouts in circuits of more than 150 volts to ground and cartridge fuses in circuits of any voltage, where accessible to other than qualified persons, so that each individual circuit containing fuses or thermal cutouts can be independently disconnected from the source of electrical energy, except as provided in Section 230-73 and except that a single disconnecting means may be used to control a group of circuits each protected by fuses or thermal cutouts under the conditions described in Section 430-112.

240-19. Arcing or Suddenly Moving Parts. Arcing or suddenly moving parts shall comply with the following:

(a) **Location.** Fuses and circuit breakers shall be so located or shielded that persons will not be burned or otherwise injured by their operation.

(b) **Suddenly Moving Parts.** Handles or levers of circuit breakers, and similar parts which may move suddenly in such a way that persons in the vicinity are liable to be injured by being struck by them, shall be guarded or isolated.

E. Plug Fuses and Fuseholders

240-20. Plug Fuses of the Edison-Base Type. Plug fuses of the Edison-base type shall conform to the following:

(a) **Classification.** Plug fuses of this type shall be classified at not over 125 volts, 0 to 30 amperes.

(b) **Live Parts.** Fuses and fuseholders when installed and assembled together shall have no live parts exposed.

(c) **Marking.** Plug fuses of 15 amperes rating or less shall be distinguished from those of larger rating by an hexagonal opening in the cap through which the mica or similar window shows, or by some other prominent hexagonal feature such as the form of the top or cap itself, or an hexagonal recess or projection in the top or cap.

Plug fuses of the Edison-base type are recognized in this Code only as a replacement item in existing installations where there has been no evidence of overfusing or tampering.

240-21. Fuseholders for Plug Fuses. Fuseholders for plug fuses of 30 amperes or less shall not be installed unless they comply with Section 240-22 or are made to comply with Section 240-22 by the insertion of an adapter.

240-22. Plug Fuses and Fuseholders of Type S. Where Type S plug fuses are to be used as the overcurrent device required by this Code, the fuses and fuseholders shall conform to the following requirements:

(a) **Classification.** Plug fuses and fuseholders of Type S shall be classified at not over 125 volts; 0 to 15 amperes, 16 to 20 amperes, and 21 to 30 amperes.

(b) **Use of Fuses in a Fuseholder of a Different Classification.** Fuses of the 16 to 20 ampere and the 21 to 30 ampere classification shall not be usable with fuseholders or adapters of a lower ampere classification.

(c) **Fuseholders and Adapters.** Fuses, fuseholders, and adapters shall be so designed that a fuse other than a Type S fuse cannot be used in a fuseholder or adapter designed for Type S fuses.

(d) **Tamperability.** Fuses, fuseholders and adapters shall be so designed as to be subject to tampering or bridging only with difficulty.

(e) **Adapters to be Nonremovable.** Fuse adapters shall be so designed that when once inserted in a fuseholder they cannot be removed.

(f) **Interchangeability.** Fuses, fuseholders and adapters of various manufacturers shall be interchangeable with each other, and the plugs with adapters shall be suitable for use in the Edison-base type fuseholder.

(g) **Plug Type.** Fuses and fuseholders shall be of the plug type.

(h) **Ampere Rating.** Each fuse, fuseholder and adapter shall be marked with its ampere rating.

(i) **Marking.** Fuses of the 0 to 15 ampere rating shall be distinguished from those of larger rating by an hexagonal opening in the cap through which the mica or similar window shows, or some other prominent hexagonal feature such as the form of the top or cap itself, or an hexagonal recess or projection in the top or cap.

F. Cartridge Fuses and Fuseholders

240-23. Cartridge Fuses and Fuseholders. Cartridge fuses and fuseholders shall conform to the following:

(a) Classification.

(1) 0-600 ampere cartridge fuses and fuseholders shall be classified as regards current and voltage as follows:

Not over 250 volts Amperes	Not over 300 volts Amperes	Not over 600 volts Amperes
0- 30		0- 30
31- 60	0-15	31- 60
61-100	16-20	61-100
101-200	21-30	101-200
201-400	31-60	201-400
401-600		401-600

(2) 601-6000 ampere cartridge fuses and fuseholders shall be classified at 600 volts as follows:

601- 800	1601-2000	3001-4000
801-1200	2001-2500	4001-5000
1201-1600	2501-3000	5001-6000

There are no 250 volt ratings over 600 amperes, but 600 volt fuses may be used for lower voltages.

(b) Noninterchangeable - 0-6000 Ampere Cartridge Fuseholders.

Fuseholders shall be so designed that it will be difficult to put a fuse of any given class into a fuseholder which is designed for a current lower, or voltage higher, than that of the class to which it belongs. Fuseholders for current limiting fuses shall not permit insertion of fuses which are not current limiting.

(c) Marking. Fuses shall be plainly marked with the ampere rating, voltage rating, interrupting rating when greater than 10,000 amperes, current limitation where it applies, and the name or trademark of the maker. The marking shall be either by direct printing on the fuse barrel or by means of an attached label.

G. Link Fuses and Fuseholders

240-24. Link Fuses and Fuseholders. Link fuses and fuseholders shall be used only by special permission and shall conform to the following:

(a) Mounting. Link fuses shall be mounted on approved fuseholders.

(b) Dimensions. Link fuses and fuseholders shall have the following dimensions in inches:

<u>Amperes Capacity</u>	<u>Minimum Separation of Nearest Metal Parts of Opposite Polarity</u>	<u>Minimum Break Distance</u>
Not over 125 volts 601-1500		1 1/2
Not over 250 volts 601-1500	1 1/2	2
	2 3/4	

For 3-wire systems, link fuses, and fuseholders shall have the break distance required for circuits of the potential of the outside wires, except that in 125-250-volt systems with grounded neutral the fuses and fuseholders in 2-wire, 125-volt branch circuits may have the spacing specified for not over 125 volts.

(c) **Spacing.** A space shall be maintained between the fuse terminals of link fuses of the same polarity of at least 1/2 inch for voltages up to 125, and of at least 3/4 inch for voltages from 126 to 250. This is the minimum distance allowable and greater separation shall be provided where practicable.

(d) **Material.** Contact surfaces or tops of link fuses shall be of copper or aluminum having good electrical connections with the fusible part of the strip.

(e) **Minimum Rating.** Link fuses and fuseholders shall be used only in sizes rated at more than 600 amperes, and only by special permission.

(f) **Marking.** Link fuses shall be stamped with 80 per cent of the maximum current which they can carry indefinitely.

H. Circuit Breakers

240-25. Circuit Breakers. Circuit breakers shall conform to the following:

(a) **Method of Operation.** In general, circuit breakers shall be capable of being closed and opened by hand without employing any other source of power, although normal operation may be by other power such as electrical, pneumatic, and the like. Large circuit breakers which are to be closed and opened by electrical, pneumatic, or other power shall be capable of being closed by hand for maintenance purposes and shall also be capable of being tripped by hand under load without the use of power.

(b) **Type of Operation.** Circuit breakers of the 0 to 30 ampere class should be of the time-delay type.

(c) **Injury to Operator.** Circuit breakers shall be arranged and mounted so that their operation is not likely to injure the operator.

(d) **Indication.** Circuit breakers shall indicate whether they are in the open or closed position.

(e) **Nontamperable.** An air circuit breaker, used for the branch circuits described in Article 210, shall be of such design that any alteration of its trip point (calibration), or in the time required for its operation, will be difficult.

(f) **Marking.** Circuit breakers shall be marked with their rating in such a manner that the marking will be durable and visible after installation except that it may be necessary to remove a trim or cover. The ampere rating of circuit breakers rated 100 amperes or less and 600 volts or less shall be molded, stamped, etched, or similarly marked into the handle or the escutcheon area of the circuit breaker. Each circuit breaker intended to interrupt fault currents greater than 10,000 amperes shall have its interrupting rating shown on the label or on the product.

I. General

240-27. Current Limiting Overcurrent Protective Device. A current limiting overcurrent protective device is a device which, when interrupting a specified circuit, will consistently limit the short-circuit current in that circuit to a specified magnitude substantially less than that obtainable in the same circuit if the device were replaced with a solid conductor having comparable impedance.

240-30. Supplementary Overcurrent Protection. Where supplementary overcurrent protection is utilized in connection with appliances or other utilization equipment to provide individual protection for specific components or internal circuits within the equipment itself, this does not abrogate any of the requirements applicable to branch circuits and is not to be used as a substitute for branch-circuit protection.

It is not the intent of the above requirement that supplementary overcurrent protective devices be subject to the accessibility requirements as given elsewhere in this code for branch circuit overcurrent protective devices.