

## CHAPTER 37

# BRANCH CIRCUIT AND FEEDER REQUIREMENTS

### SECTION E3701 GENERAL

**E3701.1 Scope.** This chapter covers branch circuits and feeders and specifies the minimum required branch circuits, the allowable loads and the required overcurrent protection for branch circuits and feeders that serve less than 100 percent of the total dwelling unit load. Feeder circuits that serve 100 percent of the dwelling unit load shall be sized in accordance with the procedures in Chapter 36.

**E3701.2 Branch-circuit and feeder ampacity.** Branch-circuit and feeder conductors shall have ampacities not less than the maximum load to be served. Where a branch circuit or a feeder supplies continuous loads or any combination of continuous and noncontinuous loads, the minimum branch-circuit or feeder conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity equal to or greater than the noncontinuous load plus 125 percent of the continuous load.

**Exception:** The grounded conductors of branch circuits and feeders that are not connected to an overcurrent device shall be permitted to be sized at 100 percent of the continuous and noncontinuous load.

**E3701.3 Selection of ampacity.** Where more than one calculated or tabulated ampacity could apply for a given circuit length, the lowest value shall be used.

**Exception:** Where two different ampacities apply to adjacent portions of a circuit, the higher ampacity shall be permitted to be used beyond the point of transition, a distance equal to 10 feet (3048 mm) or 10 percent of the circuit length figured at the higher ampacity, whichever is less.

**E3701.4 Multi-outlet branch circuits.** Conductors of multi-outlet branch circuits supplying more than one receptacle for cord-and-plug-connected portable loads shall have ampacities of not less than the rating of the branch circuit.

**E3701.5 Multiwire branch circuits.** All conductors for multiwire branch circuits shall originate from the same panelboard or similar distribution equipment. Except where all ungrounded conductors are opened simultaneously by the branch-circuit overcurrent device, multiwire branch circuits shall supply only line-to-neutral loads or only one appliance.

**E3701.5.1 Disconnecting means.** Each multiwire branch circuit shall be provided with a means that will simultaneously disconnect all ungrounded conductors at the point where the branch circuit originates.

**E3701.5.2 Grouping.** The ungrounded and grounded conductors of each multiwire branch circuit shall be grouped by wire ties or similar means in at least one location within the panelboard or other point of origination.

**Exception:** Grouping shall not be required where the circuit conductors enter from a cable or raceway unique to the circuit, thereby making the grouping obvious.

### SECTION E3702 BRANCH CIRCUIT RATINGS

**E3702.1 Branch-circuit voltage limitations.** The voltage ratings of branch circuits that supply luminaires or receptacles for cord-and-plug-connected loads of up to 1,440 volt-amperes or of less than  $\frac{1}{4}$  horsepower shall be limited to a maximum rating of 120 volts, nominal, between conductors.

Branch circuits that supply cord-and-plug-connected or permanently connected utilization equipment and appliances rated at over 1,440 volt-amperes or  $\frac{1}{4}$  horsepower (0.186 kW) and greater shall be rated at 120 volts or 240 volts, nominal.

**E3702.2 Branch-circuit ampere rating.** Branch circuits shall be rated in accordance with the maximum allowable ampere rating or setting of the overcurrent protection device. The rating for other than individual branch circuits shall be 15, 20, 30, 40 and 50 amperes. Where conductors of higher ampacity are used, the ampere rating or setting of the specified over-current device shall determine the circuit rating.

**E3702.3 Fifteen- and 20-ampere branch circuits.** A 15- or 20-ampere branch circuit shall be permitted to supply lighting units, or other utilization equipment, or a combination of both. The rating of any one cord-and-plug-connected utilization equipment not fastened in place shall not exceed 80 percent of the branch-circuit ampere rating. The total rating of utilization equipment fastened in place, other than luminaires, shall not exceed 50 percent of the branch-circuit ampere rating where lighting units, cord-and-plug-connected utilization equipment not fastened in place, or both, are also supplied.

**E3702.4 Thirty-ampere branch circuits.** A 30-ampere branch circuit shall be permitted to supply fixed utilization equipment. A rating of any one cord-and-plug-connected utilization equipment shall not exceed 80 percent of the branch-circuit ampere rating.

**E3702.5 Branch circuits serving multiple loads or outlets.** General-purpose branch circuits shall supply lighting outlets, appliances, equipment or receptacle outlets, and combinations of such. Multi-outlet branch circuits serving lighting or receptacles shall be limited to a maximum branch-circuit rating of 20 amperes.

**E3702.6 Branch circuits serving a single motor.** Branch-circuit conductors supplying a single motor shall have an ampacity not less than 125 percent of the motor full-load current rating.

**E3702.7 Branch circuits serving motor-operated and combination loads.** For circuits supplying loads consisting of motor-operated utilization equipment that is fastened in place and that has a motor larger than  $\frac{1}{8}$  horsepower (0.093 kW) in combination with other loads, the total calculated load shall be based on 125 percent of the largest motor load plus the sum of the other loads.

**E3702.8 Branch-circuit inductive lighting loads.** For circuits supplying luminaires having ballasts, the calculated load shall

be based on the total ampere ratings of such units and not on the total watts of the lamps.

**E3702.9 Branch-circuit load for ranges and cooking appliances.** It shall be permissible to calculate the branch-circuit load for one range in accordance with Table E3704.2(2). The branch-circuit load for one wall-mounted oven or one counter-mounted cooking unit shall be the nameplate rating of the appliance. The branch-circuit load for a counter-mounted cooking unit and not more than two wall-mounted ovens all supplied from a single branch circuit and located in the same room shall be calculated by adding the nameplate ratings of the individual appliances and treating the total as equivalent to one range.

**E3702.9.1 Minimum branch circuit for ranges.** Ranges with a rating of 8.75 kVA or more shall be supplied by a branch circuit having a minimum rating of 40 amperes.

**E3702.10 Branch circuits serving heating loads.** Electric space-heating and water-heating appliances shall be considered continuous loads. Branch circuits supplying two or more outlets for fixed electric space-heating equipment shall be rated 15, 20, 25 or 30 amperes.

**E3702.11 Branch circuits for air-conditioning and heat pump equipment.** The ampacity of the conductors supplying multimotor and combination load equipment shall not be less than the minimum circuit ampacity marked on the equipment. The branch-circuit overcurrent device rating shall be the size and type marked on the appliance.

**E3702.12 Branch circuits serving room air conditioners.** A room air conditioner shall be considered as a single motor unit in determining its branch-circuit requirements where all the following conditions are met:

1. It is cord- and attachment plug-connected.
2. The rating is not more than 40 amperes and 250 volts; single phase.
3. Total rated-load current is shown on the room air-conditioner nameplate rather than individual motor currents.
4. The rating of the branch-circuit short-circuit and ground-fault protective device does not exceed the ampacity of the branch-circuit conductors, or the rating of the branch-circuit conductors, or the rating of the receptacle, whichever is less.

**E3702.12.1 Where no other loads are supplied.** The total marked rating of a cord- and attachment plug-connected room air conditioner shall not exceed 80 percent of the rating of a branch circuit where no other appliances are also supplied.

**E3702.12.2 Where lighting units or other appliances are also supplied.** The total marked rating of a cord- and attachment plug-connected room air conditioner shall not exceed 50 percent of the rating of a branch circuit where lighting or other appliances are also supplied. Where the circuitry is interlocked to prevent simultaneous operation of the room air conditioner and energization of other outlets on the same branch circuit, a cord- and attachment-plug-connected room air conditioner shall not exceed 80 percent of the branch-circuit rating.

**E3702.13 Branch-circuit requirement—summary.** The requirements for circuits having two or more outlets, or receptacles, other than the receptacle circuits of Sections E3703.2 and E3703.3, are summarized in Table E3702.13. Branch circuits in dwelling units shall supply only loads within that dwelling unit or loads associated only with that dwelling unit. Branch circuits required for the purpose of lighting, central alarm, signal, communications or other needs for public or common areas of a two-family dwelling shall not be supplied from equipment that supplies an individual dwelling unit.

**TABLE E3702.13  
BRANCH-CIRCUIT REQUIREMENTS—SUMMARY<sup>a,b</sup>**

	CIRCUIT RATING		
	15 amp	20 amp	30 amp
Conductors: Minimum size (AWG) circuit conductors	14	12	10
Maximum overcurrent- protection device rating Ampere rating	15	20	30
Outlet devices: Lampholders permitted Receptacle rating (amperes)	Any type 15 maximum	Any type 15 or 20	N/A 30
Maximum load (amperes)	15	20	30

a. These gages are for copper conductors.

b. N/A means not allowed.

**SECTION E3703  
REQUIRED BRANCH CIRCUITS**

**E3703.1 Branch circuits for heating.** Central heating equipment other than fixed electric space heating shall be supplied by an individual branch circuit. Permanently connected air-conditioning equipment, and auxiliary equipment directly associated with the central heating equipment such as pumps, motorized valves, humidifiers and electrostatic air cleaners, shall not be prohibited from connecting to the same branch circuit as the central heating equipment.

**E3703.2 Kitchen and dining area receptacles.** A minimum of two 20-ampere-rated branch circuits shall be provided to serve all wall and floor receptacle outlets located in the kitchen, pantry, breakfast area, dining area or similar area of a dwelling. The kitchen countertop receptacles shall be served by a minimum of two 20-ampere-rated branch circuits, either or both of which shall also be permitted to supply other receptacle outlets in the same kitchen, pantry, breakfast and dining area including receptacle outlets for refrigeration appliances.

**Exception:** The receptacle outlet for refrigeration appliances shall be permitted to be supplied from an individual branch circuit rated 15 amperes or greater.

**E3703.3 Laundry circuit.** A minimum of one 20-ampere-rated branch circuit shall be provided for receptacles located in the laundry area and shall serve only receptacle outlets located in the laundry area.

**E3703.4 Bathroom branch circuits.** A minimum of one 20-ampere branch circuit shall be provided to supply bathroom receptacle outlet(s). Such circuits shall have no other outlets.

**Exception:** Where the 20-ampere circuit supplies a single bathroom, outlets for other equipment within the same bathroom shall be permitted to be supplied in accordance with Section E3702.

**E3703.5 Number of branch circuits.** The minimum number of branch circuits shall be determined from the total calculated load and the size or rating of the circuits used. The number of circuits shall be sufficient to supply the load served. In no case shall the load on any circuit exceed the maximum specified by Section E3702.

**E3703.6 Branch-circuit load proportioning.** Where the branch-circuit load is calculated on a volt-amperes-per-square-foot (m<sup>2</sup>) basis, the wiring system, up to and including the branch-circuit panelboard(s), shall have the capacity to serve not less than the calculated load. This load shall be evenly proportioned among multioutlet branch circuits within the panelboard(s). Branch-circuit overcurrent devices and circuits shall only be required to be installed to serve the connected load.

**SECTION E3704  
FEEDER REQUIREMENTS**

**E3704.1 Conductor size.** Feeder conductors that do not serve 100 percent of the dwelling unit load and branch-circuit conductors shall be of a size sufficient to carry the load as determined by this chapter. Feeder conductors shall not be required to be larger than the service-entrance conductors that supply the dwelling unit. The load for feeder conductors that serve as

the main power feeder to a dwelling unit shall be determined as specified in Chapter 36 for services.

**E3704.2 Feeder loads.** The minimum load in volt-amperes shall be calculated in accordance with the load calculation procedure prescribed in Table E3704.2(1). The associated table demand factors shall be applied to the actual load to determine the minimum load for feeders.

**E3704.3 Feeder neutral load.** The feeder neutral load shall be the maximum unbalance of the load determined in accordance with this chapter. The maximum unbalanced load shall be the maximum net calculated load between the neutral and any one ungrounded conductor. For a feeder or service supplying electric ranges, wall-mounted ovens, counter-mounted cooking units and electric dryers, the maximum unbalanced load shall be considered as 70 percent of the load on the ungrounded conductors.

**E3704.4 Lighting and general use receptacle load.** A unit load of not less than 3 volt-amperes shall constitute the minimum lighting and general use receptacle load for each square foot of floor area (33 VA for each square meter of floor area). The floor area for each floor shall be calculated from the outside dimensions of the building. The calculated floor area shall not include open porches, garages, or unused or unfinished spaces not adaptable for future use.

**E3704.5 Ampacity and calculated loads.** The calculated load of a feeder shall be not less than the sum of the loads on the branch circuits supplied, as determined by Section E3704, after any applicable demand factors permitted by Section E3704 have been applied.

**E3704.6 Equipment grounding conductor.** Where a feeder supplies branch circuits in which equipment grounding conductors are required, the feeder shall include or provide an

**TABLE E3704.2(1)  
FEEDER LOAD CALCULATION**

LOAD CALCULATION PROCEDURE	APPLIED DEMAND FACTOR
Lighting and receptacles: A unit load of not less than 3 VA per square foot of total floor area shall constitute the lighting and 120-volt, 15- and 20-ampere general use receptacle load. 1,500 VA shall be added for each 20-ampere branch circuit serving receptacles in the kitchen, dining room, pantry, breakfast area and laundry area.	100 percent of first 3,000 VA or less and 35 percent of that in excess of 3,000 VA.
<b>Plus</b>	
Appliances and motors: The nameplate rating load of all fastened-in-place appliances other than dryers, ranges, air-conditioning and space-heating equipment.	100 percent of load for three or less appliances. 75 percent of load for four or more appliances.
<b>Plus</b>	
Fixed motors: Full-load current of motors plus 25 percent of the full load current of the largest motor.	
<b>Plus</b>	
Electric clothes dryer: The dryer load shall be 5,000 VA for each dryer circuit or the nameplate rating load of each dryer, whichever is greater.	
<b>Plus</b>	
Cooking appliances: The nameplate rating of ranges, wall-mounted ovens, counter-mounted cooking units and other cooking appliances rated in excess of 1.75 kVA shall be summed.	Demand factors shall be as allowed by Table E3704.2(2).
<b>Plus the largest of either the heating or cooling load</b>	
Largest of the following two selections: <ol style="list-style-type: none"> <li>1. 100 percent of the nameplate rating(s) of the air conditioning and cooling, including heat pump compressors.</li> <li>2. 100 percent of the fixed electric space heating.</li> </ol>	

For SI: 1 square foot = 0.0929 m<sup>2</sup>.

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equipment grounding conductor that is one or more or a combination of the types specified in Section E3908.8, to which the equipment grounding conductors of the branch circuits shall be connected. Where the feeder supplies a separate building or structure, the requirements of Section E3607.3.1 shall apply.

**SECTION E3705  
CONDUCTOR SIZING  
AND OVERCURRENT PROTECTION**

**E3705.1 General.** Ampacities for conductors shall be determined based in accordance with Table E3705.1 and Sections E3705.2 and E3705.3.

**E3705.2 Correction factor for ambient temperatures.** For ambient temperatures other than 30°C (86°F), multiply the

allowable ampacities specified in Table E3705.1 by the appropriate correction factor shown in Table E3705.2.

**E3705.3 Adjustment factor for conductor proximity.** Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are stacked or bundled for distances greater than 24 inches (610 mm) without maintaining spacing and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table E3705.3.

**Exceptions:**

1. Adjustment factors shall not apply to conductors in nipples having a length not exceeding 24 inches (610 mm).
2. Adjustment factors shall not apply to underground conductors entering or leaving an outdoor trench if those conductors have physical protection in the form

**TABLE E3704.2(2)  
DEMAND LOADS FOR ELECTRIC RANGES, WALL-MOUNTED OVENS, COUNTER-MOUNTED COOKING UNITS AND OTHER COOKING APPLIANCES OVER 1<sup>3</sup>/<sub>4</sub> kVA RATING<sup>a,b</sup>**

NUMBER OF APPLIANCES	MAXIMUM DEMAND <sup>b,c</sup>	DEMAND FACTORS (percent) <sup>d</sup>	
	Column A maximum 12 kVA rating	Column B less than 3 <sup>1</sup> / <sub>2</sub> kVA rating	Column C 3 <sup>1</sup> / <sub>2</sub> to 8 <sup>3</sup> / <sub>4</sub> kVA rating
1	8 kVA	80	80
2	11 kVA	75	65

- a. Column A shall be used in all cases except as provided for in Footnote d.
- b. For ranges all having the same rating and individually rated more than 12 kVA but not more than 27 kVA, the maximum demand in Column A shall be increased 5 percent for each additional kVA of rating or major fraction thereof by which the rating of individual ranges exceeds 12 kVA.
- c. For ranges of unequal ratings and individually rated more than 8.75 kVA, but none exceeding 27 kVA, an average value of rating shall be computed by adding together the ratings of all ranges to obtain the total connected load (using 12 kVA for any ranges rated less than 12 kVA) and dividing by the total number of ranges; and then the maximum demand in Column A shall be increased 5 percent for each kVA or major fraction thereof by which this average value exceeds 12 kVA.
- d. Over 1.75 kVA through 8.75 kVA. As an alternative to the method provided in Column A, the nameplate ratings of all ranges rated more than 1.75 kVA but not more than 8.75 kVA shall be added and the sum shall be multiplied by the demand factor specified in Column B or C for the given number of appliances.

**TABLE E3705.1  
ALLOWABLE AMPACITIES**

CONDUCTOR SIZE	CONDUCTOR TEMPERATURE RATING						CONDUCTOR SIZE
	60°C	75°C	90°C	60°C	75°C	90°C	
	Types RHW, THHW, THW, THWN, USE, XHHW	Types RHW, THHW, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	Types RHW-2, THHN, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	Types TW, UF	Types RHW, THHW, THW, THWN, USE, XHHW	Types RHW-2, THHN, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	
AWG kcmil	Copper			Aluminum or copper-clad aluminum			AWG kcmil
18	—	—	14	—	—	—	—
16	—	—	18	—	—	—	—
14	20	20	25	—	—	—	—
12	25	25	30	20	20	25	12
10	30	35	40	25	30	35	10
8	40	50	55	30	40	45	8
6	55	65	75	40	50	60	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	150	85	100	115	1
1/0	125	150	170	100	120	135	1/0
2/0	145	175	195	115	135	150	2/0
3/0	165	200	225	130	155	175	3/0
4/0	195	230	260	150	180	205	4/0

For SI: °C = [(°F) – 32]/1.8.

**TABLE E3705.2  
AMBIENT TEMPERATURE CORRECTION FACTORS**

AMBIENT TEMP. °C	FOR AMBIENT TEMPERATURES OTHER THAN 30°C (86°F), MULTIPLY THE ALLOWABLE AMPACITIES SPECIFIED IN TABLE E3705.1 BY THE APPROPRIATE FACTOR SHOWN BELOW						AMBIENT TEMP. °F
	CONDUCTOR TEMPERATURE RATING						
	60°C	75°C	90°C	60°C	75°C	90°C	
	Types TW, UF	Types RHW, THHW, THW, THWN, USE, XHHW	Types RHW-2, THHN, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	Types TW, UF	Types RHW, THHW, THW, THWN, USE, XHHW	Types RHW-2, THHN, THHW, THW-2, THWN-2, XHHW, XHHW-2, USE-2	
Copper			Aluminum or copper-clad aluminum				
21-25	1.08	1.05	1.04	1.08	1.05	1.04	70-77
26-30	1.00	1.00	1.00	1.00	1.00	1.00	78-86
31-35	0.91	0.94	0.96	0.91	0.94	0.96	87-95
36-40	0.82	0.88	0.91	0.82	0.88	0.91	96-104
41-45	0.71	0.82	0.87	0.71	0.82	0.87	105-113
46-50	0.58	0.75	0.82	0.58	0.75	0.82	114-122
51-55	0.41	0.67	0.76	0.41	0.67	0.76	123-131
56-60	—	0.58	0.71	—	0.58	0.71	132-140
61-70	—	0.33	0.58	—	0.33	0.58	141-158
71-80	—	—	0.41	—	—	0.41	159-176

of rigid metal conduit, intermediate metal conduit, or rigid nonmetallic conduit having a length not exceeding 10 feet (3048 mm) and the number of conductors does not exceed four.

3. Adjustment factors shall not apply to type AC cable or to type MC cable without an overall outer jacket meeting all of the following conditions:
  - 3.1. Each cable has not more than three current-carrying conductors.
  - 3.2. The conductors are 12 AWG copper.
  - 3.3. Not more than 20 current-carrying conductors are bundled, stacked or supported on bridle rings. A 60 percent adjustment factor shall be applied where the current-carrying conductors in such cables exceed 20 and the cables are stacked or bundled for distances greater than 24 inches (610 mm) without maintaining spacing.

**TABLE E3705.3  
CONDUCTOR PROXIMITY ADJUSTMENT FACTORS**

NUMBER OF CURRENT-CARRYING CONDUCTORS IN CABLE OR RACEWAY	PERCENT OF VALUES IN TABLE E3705.1
4-6	80
7-9	70
10-20	50
21-30	45
31-40	40
41 and above	35

**E3705.4 Temperature limitations.** The temperature rating associated with the ampacity of a conductor shall be so selected and coordinated to not exceed the lowest temperature rating of any connected termination, conductor or device. Conductors with temperature ratings higher than specified for terminations

shall be permitted to be used for ampacity adjustment, correction, or both. Except where the equipment is marked otherwise, conductor ampacities used in determining equipment termination provisions shall be based on Table E3705.1.

**E3705.4.1 Conductors rated 60°C.** Except where the equipment is marked otherwise, termination provisions of equipment for circuits rated 100 amperes or less, or marked for 14 AWG through 1 AWG conductors, shall be used only for one of the following:

1. Conductors rated 60°C (140°F);
2. Conductors with higher temperature ratings, provided that the ampacity of such conductors is determined based on the 60°C (140°F) ampacity of the conductor size used;
3. Conductors with higher temperature ratings where the equipment is listed and identified for use with such conductors; or
4. For motors marked with design letters B, C, or D conductors having an insulation rating of 75°C (167°F) or higher shall be permitted to be used provided that the ampacity of such conductors does not exceed the 75°C (167°F) ampacity.

**E3705.4.2 Conductors rated 75°C.** Termination provisions of equipment for circuits rated over 100 amperes, or marked for conductors larger than 1 AWG, shall be used only for:

1. Conductors rated 75°C (167°F).
2. Conductors with higher temperature ratings provided that the ampacity of such conductors does not exceed the 75°C (167°F) ampacity of the conductor size used, or provided that the equipment is listed and identified for use with such conductors.

**E3705.4.3 Separately installed pressure connectors.** Separately installed pressure connectors shall be used with conductors at the ampacities not exceeding the ampacity at the listed and identified temperature rating of the connector.

**E3705.4.4 Conductors of Type NM cable.** Conductors in NM cable assemblies shall be rated at 90°C (194°F). Types NM, NMC, and NMS cable identified by the markings NM-B, NMC-B, and NMS-B meet this requirement. The ampacity of Types NM, NMC, and NMS cable shall be at 60°C (140°F) conductors and shall comply with Section E3705.1 and Table E3705.5.3. The 90°C (194°F) rating shall be permitted to be used for ampacity correction and adjustment purposes provided that the final corrected or adjusted ampacity does not exceed that for a 60°C (140°F) rated conductor. Where more than two NM cables containing two or more current-carrying conductors are installed, without maintaining spacing between the cables, through the same opening in wood framing that is to be fire- or draft-stopped using thermal insulation, caulk or sealing foam, the allowable ampacity of each conductor shall be adjusted in accordance with Table E3705.3. Where more than two NM cables containing two or more current-carrying conductors are installed in contact with thermal insulation without maintaining spacing between cables, the allowable ampacity of each conductor shall be adjusted in accordance with Table E3705.3.

**E3705.5 Overcurrent protection required.** All ungrounded branch-circuit and feeder conductors shall be protected against overcurrent by an overcurrent device installed at the point where the conductors receive their supply. Overcurrent devices shall not be connected in series with a grounded conductor. Overcurrent protection and allowable loads for branch circuits and feeders that do not serve as the main power feeder to the dwelling unit load shall be in accordance with this chapter.

Branch-circuit conductors and equipment shall be protected by overcurrent protective devices having a rating or setting not exceeding the allowable ampacity specified in Table E3705.1 and Sections E3705.2, E3705.3 and E3705.4 except where otherwise permitted or required in Sections E3705.5.1 through E3705.5.3.

**E3705.5.1 Cords.** Cords shall be protected in accordance with Section E3909.2.

**E3705.5.2 Overcurrent devices of the next higher rating.** The next higher standard overcurrent device rating, above the ampacity of the conductors being protected, shall be permitted to be used, provided that all of the following conditions are met:

1. The conductors being protected are not part of a multioutlet branch circuit supplying receptacles for cord- and plug-connected portable loads.
2. The ampacity of conductors does not correspond with the standard ampere rating of a fuse or a circuit breaker without overload trip adjustments above its rating (but that shall be permitted to have other trip or rating adjustments).
3. The next higher standard device rating does not exceed 400 amperes.

**E3705.5.3 Small conductors.** Except as specifically permitted by Section E3705.5.4, the rating of overcurrent protection devices shall not exceed the ratings shown in Table E3705.5.3 for the conductors specified therein.

**E3705.5.4 Air-conditioning and heat pump equipment.** Air-conditioning and heat pump equipment circuit conductors shall be permitted to be protected against overcurrent in accordance with Section E3702.11.

**E3705.6 Fuses and fixed trip circuit breakers.** The standard ampere ratings for fuses and inverse time circuit breakers shall be considered 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100, 110, 125, 150, 175, 200, 225, 250, 300, 350 and 400 amperes.

**TABLE E3705.5.3  
OVERCURRENT-PROTECTION RATING**

COPPER		ALUMINUM OR COPPER-CLAD ALUMINUM	
Size (AWG)	Maximum overcurrent-protection-device rating <sup>a</sup> (amps)	Size (AWG)	Maximum overcurrent-protection-device rating <sup>a</sup> (amps)
14	15	12	15
12	20	10	25
10	30	8	30

a. The maximum overcurrent-protection-device rating shall not exceed the conductor allowable ampacity determined by the application of the correction and adjustment factors in accordance with Sections E3705.2 and E3705.3.

**E3705.7 Location of overcurrent devices in or on premises.** Overcurrent devices shall:

1. Be readily accessible.
2. Not be located where they will be exposed to physical damage.
3. Not be located where they will be in the vicinity of easily ignitable material such as in clothes closets.
4. Not be located in bathrooms.
5. Not be located over steps of a stairway.
6. Be installed so that the center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, is not more than 6 feet 7 inches (2007 mm) above the floor or working platform.

**Exceptions:**

1. This section shall not apply to supplementary overcurrent protection that is integral to utilization equipment.
2. Overcurrent devices installed adjacent to the utilization equipment that they supply shall be permitted to be accessible by portable means.

**E3705.8 Ready access for occupants.** Each occupant shall have ready access to all overcurrent devices protecting the conductors supplying that occupancy.

**E3705.9 Enclosures for overcurrent devices.** Overcurrent devices shall be enclosed in cabinets or cutout boxes except where an overcurrent device is part of an assembly that pro-

vides equivalent protection. The operating handle of a circuit breaker shall be permitted to be accessible without opening a door or cover.

## SECTION E3706 PANELBOARDS

**E3706.1 Panelboard rating.** All panelboards shall have a rating not less than that of the minimum service entrance or feeder capacity required for the calculated load.

**E3706.2 Panelboard circuit identification.** All circuits and circuit modifications shall be legibly identified as to their clear, evident, and specific purpose or use. The identification shall include sufficient detail to allow each circuit to be distinguished from all others. Spare positions that contain unused overcurrent devices or switches shall be described accordingly. The identification shall be included in a circuit directory located on the face of the panelboard enclosure or inside the panel door. Circuits shall not be described in a manner that depends on transient conditions of occupancy.

**E3706.3 Panelboard overcurrent protection.** In addition to the requirement of Section E3706.1, a panelboard shall be protected by an overcurrent protective device having a rating not greater than that of the panelboard. Such overcurrent protective device shall be located within or at any point on the supply side of the panelboard.

**E3706.4 Grounded conductor terminations.** Each grounded conductor shall terminate within the panelboard on an individual terminal that is not also used for another conductor, except that grounded conductors of circuits with parallel conductors shall be permitted to terminate on a single terminal where the terminal is identified for connection of more than one conductor.

**E3706.5 Back-fed devices.** Plug-in-type overcurrent protection devices or plug-in-type main lug assemblies that are back-fed and used to terminate field-installed ungrounded supply conductors shall be secured in place by an additional fastener that requires other than a pull to release the device from the mounting means on the panel.

