Section 8 — Circuit loading and demand factors

Scope

8-000 Scope

This Section covers

(a) conductor ampacities and equipment ratings required for consumer's services, feeders, and branch circuits; and

(b) branch circuit positions required for dwelling units.

Δ **8-002 Special terminology** (see Appendix B)

Basic load — the load of lighting and receptacle circuits, based on the outside dimensions of a specific area of building occupancy, as listed in Table 14.

Calculated load — the load calculated in accordance with the applicable requirements of this Section.

Demonstrated load — historical maximum demand watt information recorded over at least a 24-month period for the same type of facility as the one in question, equated to watts per m^2.

General

8-100 Current calculations

When calculating currents that will result from loads, expressed in watts or volt amperes, to be supplied by a low-voltage ac system, the voltage divisors to be used shall be 120, 208, 240, 277, 347, 416, 480, or 600 as applicable.

Δ **8-102 Voltage drop** (see Appendices B and D)

(1) The voltage drop in an installation shall be based on the connected load of the feeder or branch circuit if known; otherwise it shall be based on 80% of the rating of the overload or overcurrent device protecting the branch circuit or feeder, and not exceed

(a) 3% in a feeder or branch circuit; and

(b) 5% from the supply side of the consumer's service (or equivalent) to the point of utilization.

(2) Notwithstanding Subrule (1), where overcurrent devices are selected in accordance with other Sections of this Code, the voltage drop shall be based on the calculated demand load of the feeder or branch circuit.

(3) Notwithstanding Subrule (1), wiring for general-use branch circuits rated at not more than 120 V or 20 A in dwelling units, with the conductor length measured from the supply side of the consumer's service to the furthest point of utilization in accordance with the values in Table 68, shall be acceptable.

(4) Notwithstanding Subrule (1), at industrial establishments where conditions of maintenance and supervision ensure use by qualified persons, the design shall ensure that the voltage at the point of utilization is within the rating or voltage tolerance of the connected device(s).

8-104 Maximum circuit loading (see Appendix B)

(1) The ampere rating of a consumer's service, feeder, or branch circuit shall be the ampere rating of the overcurrent device protecting the circuit or the ampacity of the conductors, whichever is less.

(2) The calculated load in a circuit shall not exceed the ampere rating of the circuit.

(3) The calculated load in a consumer's service, feeder, or branch circuit shall be considered a continuous load unless it can be shown that in normal operation it will not persist for

(a) a total of more than 1 h in any two-hour period if the load does not exceed 225 A; or

(b) a total of more than 3 h in any six-hour period if the load exceeds 225 A.

Δ (4) A load of a cyclic or intermittent nature shall be classified as continuous unless it meets the requirements of Subrule (3).

(5) Where a fused switch or circuit breaker is marked for continuous operation at 100% of the ampere rating of its overcurrent devices, the continuous load as determined from the calculated load shall not exceed

(a) 100% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 2 or 4; or

(b) 85% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 1 or 3.

(6) Where a fused switch or circuit breaker is marked for continuous operation at 80% of the ampere rating of its overcurrent devices, the continuous load as determined from the calculated load shall not exceed
  (a) 80% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 2 or 4; or
  (b) 70% of the rating of the circuit where the ampacity of the conductors is based on Column 2, 3, or 4 of Table 1 or 3.

(7) If other derating factors are applied to reduce the conductor ampacity, the conductor size shall be the greater of that so determined or that determined by Subrule (5) or (6).

(8) Notwithstanding the requirements of Rule 4-004(1)(d) and (2)(d), the ampacity of the underground conductors shall not exceed in any case those determined by Subrules (5)(b) and (6)(b) of this Rule.

8-106 Use of demand factors (see Appendix B)

(1) The size of conductors and switches computed in accordance with this Section shall be the minimum used except that, if the next smaller standard size in common use has an ampacity not more than 5% less than this minimum, the smaller size conductor shall be permitted.

(2) In any case other than a service calculated in accordance with Rules 8-200 and 8-202, where the design of an installation is based on requirements in excess of those given in this Section, the service and feeder capacities shall be increased accordingly.

(3) Where two or more loads are installed so that only one can be used at any one time, the one providing the greatest demand shall be used in determining the calculated demand.

(4) Where it is known that electric space-heating and air-conditioning loads are installed and will not be used simultaneously, whichever is the greater load shall be used in calculating the demand.

(5) Where a feeder supplies loads of a cyclic or similar nature such that the maximum connected load will not be supplied at the same time, the ampacity of the feeder conductors shall be permitted to be based on the maximum load that may be connected at any one time.

Δ (6) Where a feeder or service supplies motor or air-conditioning loads, a demand factor as determined by a qualified person shall be permitted to be applied to these loads, provided that a deviation has been allowed in accordance with Rule 2-030.

(7) The ampacity of conductors of feeders or branch circuits shall be in accordance with the Section(s) dealing with the respective equipment being supplied.

(8) Notwithstanding the requirements of this Section, the ampacity of the conductors of a feeder or branch circuit need not exceed the ampacity of the conductors of the service or of the feeder from which they are supplied.

(9) Where additional loads are to be added to an existing service or feeder, the augmented load shall be permitted to be calculated by adding the sum of the additional loads, with demand factors as permitted by this Code to the maximum demand load of the existing installation as measured over the most recent 12-month period, but the new calculated load shall be subject to Rule 8-104(5) and (6).

Δ (10) For loads other than those calculated in accordance with Rules 8-200 and 8-202, feeder and service load calculations shall be permitted to be based on demonstrated loads, provided that such calculations are performed by a qualified person, as determined by the regulatory authority having jurisdiction.

8-108 Number of branch circuit positions

(1) For a single dwelling, the panelboard shall provide space for at least the equivalent of the following number of 120 V branch circuit overcurrent devices, including space for two 35 A double-pole overcurrent devices:
  (a) 16 — of which at least half shall be double-pole, where the required ampacity of the service or feeder conductors does not exceed 60 A;
  (b) 24 — of which at least half shall be double-pole
    (i) where the required ampacity of the service or feeder conductors exceeds 60 A but does not exceed 100 A; or
    (ii) where the required ampacity of the service or feeder conductors exceeds 100 A but does not exceed 125 A and provision is made for a central electric furnace;
  (c) 30 — of which at least half shall be double-pole
    (i) where the required ampacity of the service or feeder conductors exceeds 100 A but does not exceed 125 A; or
    (ii) where the required ampacity of the service or feeder conductors exceeds 125 A but does not exceed 200 A and provision is made for a central electric furnace; and