

the total load, for a new restaurant shall be permitted in accordance with Table 220-36 in lieu of Part B of this article.

The overload protection of the service-entrance conductors shall be in accordance with Sections 230-90 and 240-3.

Feeder conductors shall not be required to be of greater ampacity than the service-entrance conductors.

Service-entrance or feeder conductors whose demand load is determined by this optional calculation shall be permitted to have the neutral load determined by Section 220-22.

**Table 220-36. Optional Method — Demand Factors for Service-Entrance and Feeder Conductors for New Restaurants**

Total Connected Load (kVA)	All Electric Demand Factor (Percent)	Not All Electric Demand Factor (Percent)
0-250	80	100
251-280	70	90
281-325	60	80
326-375	50	70
376-800	50	65
Over 800	50	50

Note: Add all electrical loads, including both heating and cooling loads, to compute the total connected load. Select the one demand factor that applies from the table and multiply the total connected load by this single demand factor.

#### D. Method for Computing Farm Loads

##### 220-40. Farm Loads — Buildings and Other Loads.

(a) **Dwelling Unit.** The feeder or service load of a farm dwelling unit shall be computed in accordance with the provisions for dwellings in Part B or C of this article. Where the dwelling has electric heat and the farm has electric grain-drying systems, Part C of this article shall not be used to compute the dwelling load.

(b) **Other than Dwelling Unit.** For each farm building or load supplied by two or more separate branch circuits, the load for feeders, service-entrance conductors, and service equipment shall be computed in accordance with demand factors not less than indicated in Table 220-40.

FPN: See Section 230-21 for overhead conductors from a pole to a building or other structure.

**220-41. Farm Loads — Total.** The total load of the farm for service-entrance conductors and service equipment shall be computed in accordance with the farm dwelling unit load and demand factors specified in Table 220-41. Where there is equipment in two or more farm equipment buildings or for loads having the same function, such loads shall be

**Table 220-40. Method for Computing Farm Loads for Other than Dwelling Unit**

Ampere Load at 240 Volts Maximum	Demand Factor (Percent)
Loads expected to operate without diversity, but not less than 125 percent full-load current of the largest motor and not less than the first 60 amperes of load	100
Next 60 amperes of all other loads	50
Remainder of other load	25

computed in accordance with Table 220-40 and shall be permitted to be combined as a single load in Table 220-41 for computing the total load.

FPN: See Section 230-21 for overhead conductors from a pole to a building or other structure.

**Table 220-41. Method for Computing Total Farm Load**

Individual Loads Computed in Accordance with Table 220-40	Demand Factor (Percent)
Largest load	100
Second largest load	75
Third largest load	65
Remaining loads	50

Note: To this total load, add the load of the farm dwelling unit computed in accordance with Part B or C of this article. Where the dwelling has electric heat and the farm has electric grain-drying systems, Part C of this article shall not be used to compute the dwelling load.

#### Article 225 — Outside Branch Circuits and Feeders

**225-1. Scope.** This article covers requirements for outside branch circuits and feeders run on or between buildings, structures, or poles on the premises; and electric equipment and wiring for the supply of utilization equipment that is located on or attached to the outside of buildings, structures, or poles.

FPN: For additional information on wiring over 600 volts, see *National Electrical Safety Code, ANSI C2-1997*.

**225-2. Other Articles.** Application of other articles, including additional requirements to specific cases of equipment and conductors, is as follows:

	Article
Branch circuits	210
Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits	725
Communications circuits	800
Community antenna television and radio distribution systems	820
Conductors for general wiring	310
Electrically driven or controlled irrigation machines	675
Electric signs and outline lighting	600
Feeders	215
Fire alarm systems	760
Fixed outdoor electric deicing and snow-melting equipment	426
Floating buildings	553
Grounding	250
Hazardous (classified) locations	500
Hazardous (classified) locations — specific	510
Marinas and boatyards	555
Messenger supported wiring	321
Open wiring on insulators	320
Over 600 volts, general	490
Overcurrent protection	240
Radio and television equipment	810
Services	230
Solar photovoltaic systems	690
Swimming pools, fountains, and similar installations	680
Use and identification of grounded conductors	200

#### A. General

##### 225-3. Calculation of Load.

(a) **Branch Circuits.** The load on outdoor branch circuits shall be as determined by Section 220-3.

(b) **Feeders.** The load on outdoor feeders shall be as determined by Part B of Article 220.

**225-4. Conductor Covering.** Where within 10 ft (3.05 m) of any building or structure other than supporting poles or towers, open individual (aerial) overhead conductors shall be insulated or covered. Conductors in cables or raceways, except Type MI cable, shall be of the rubber-covered type or thermoplastic type and, in wet locations, shall comply with Section 310-8. Conductors for festoon lighting shall be of the rubber-covered or thermoplastic type.

*Exception: Equipment grounding conductors and grounded circuit conductors shall be permitted to be bare or covered as specifically permitted elsewhere in this Code.*

**225-5. Size of Conductors.** The ampacity of outdoor branch-circuit and feeder conductors shall be in accordance with Section 310-15 based on loads as determined under Section 220-3 and Part B of Article 220.

##### 225-6. Conductor Size and Support.

(a) **Overhead Spans.** Open individual conductors shall not be smaller than the following:

- (1) For 600 volts, nominal, or less, No. 10 copper or No. 8 aluminum for spans up to 50 ft (15.2 m) in length and No. 8 copper or No. 6 aluminum for a longer span, unless supported by a messenger wire
- (2) For over 600 volts, nominal, No. 6 copper or No. 4 aluminum where open individual conductors and No. 8 copper or No. 6 aluminum where in cable

(b) **Festoon Lighting.** Overhead conductors for festoon lighting shall not be smaller than No. 12 unless the conductors are supported by messenger wires. In all spans exceeding 40 ft (12.2 m), the conductors shall be supported by messenger wire. The messenger wire shall be supported by strain insulators. Conductors or messenger wires shall not be attached to any fire escape, down spout, or plumbing equipment.

##### 225-7. Lighting Equipment Installed Outdoors.

(a) **General.** For the supply of lighting equipment installed outdoors, the branch circuits shall comply with Article 210 and (b) through (d).

(b) **Common Neutral.** The ampacity of the neutral conductor shall not be less than the maximum net computed load current between the neutral and all ungrounded conductors connected to any one phase of the circuit.

(c) **277 Volts to Ground.** Circuits exceeding 120 volts, nominal, between conductors and not exceeding 277 volts, nominal, to ground shall be permitted to supply lighting fixtures for illumination of outdoor areas of industrial establishments, office buildings, schools, stores, and other commercial or public buildings where the fixtures are not less than 3 ft (914 mm) from windows, platforms, fire escapes, and the like.

(d) **600 Volts Between Conductors.** Circuits exceeding 277 volts, nominal, to ground and not exceeding 600 volts, nominal, between conductors shall be permitted to supply the auxiliary equipment of electric-discharge lamps in accordance with Section 210-6(d)(1).

**225-9. Overcurrent Protection.** Overcurrent protection shall be in accordance with Section 210-20 for branch circuits and Article 240 for feeders.

**225-10. Wiring on Buildings.** The installation of outside wiring on surfaces of buildings shall be permitted for circuits of not over 600 volts, nominal, as open wiring on insulators, as multiconductor cable, as Type MC cable, as Type MI cable, as messenger supported wiring, in rigid metal conduit, in intermediate metal conduit, in rigid nonmetallic conduit, in cable trays, as cablebus, in wireways, in auxiliary gutters, in electrical metallic tubing, in flexible metal conduit, in liquidtight flexible metal conduit, in liquidtight flexible non-metallic conduit, and in busways. Circuits of over 600 volts, nominal, shall be installed as provided in Section 300-37. Circuits for signs and outline lighting shall be installed in accordance with Article 600.

**225-11. Circuit Exits and Entrances.** Where outside branch and feeder circuits leave or enter a building, the requirements of Sections 230-52 and 230-54 shall apply.

**225-12. Open-Conductor Supports.** Open conductors shall be supported on glass or porcelain knobs, racks, brackets, or strain insulators.

**225-14. Open-Conductor Spacings.**

(a) **600 Volts, Nominal, or Less.** Conductors of 600 volts, nominal, or less, shall comply with the spacings provided in Table 230-51(c).

(b) **Over 600 Volts, Nominal.** Conductors of over 600 volts, nominal, shall comply with the spacings provided in Sections 110-36 and 490-24.

(c) **Separation from Other Circuits.** Open conductors shall be separated from open conductors of other circuits or systems by not less than 4 in. (102 mm).

(d) **Conductors on Poles.** Conductors on poles shall have a separation of not less than 1 ft (305 mm) where not placed on racks or brackets. Conductors supported on poles shall provide a horizontal climbing space not less than the following:

- (1) Power conductors below communications conductors — 30 in. (762 mm)
- (2) Power conductors alone or above communications conductors:
  - 300 volts or less — 24 in. (610 mm)
  - Over 300 volts — 30 in. (762 mm)
- (3) Communications conductors below power conductors — same as power conductors
- (4) Communications conductors alone — no requirement

**225-15. Supports Over Buildings.** Supports over a building shall be in accordance with Section 230-29.

**225-16. Point of Attachment to Buildings.** The point of attachment to a building shall be in accordance with Section 230-26.

**225-17. Means of Attachment to Buildings.** The means of attachment to a building shall be in accordance with Section 230-27.

**225-18. Clearance from Ground.** Overhead spans of open conductors and open multiconductor cables of not over 600 volts, nominal, shall conform to the following:

10 ft (3.05 m) — above finished grade, sidewalks, or from any platform or projection from which they might be reached where the voltage does not exceed 150 volts to ground and accessible to pedestrians only

12 ft (3.66 m) — over residential property and driveways, and those commercial areas not subject to truck traffic where the voltage does not exceed 300 volts to ground

15 ft (4.57 m) — for those areas listed in the 12-ft (3.66-m) classification where the voltage exceeds 300 volts to ground

18 ft (5.49 m) — over public streets, alleys, roads, parking areas subject to truck traffic, driveways on other than residential property, and other land traversed by vehicles such as cultivated, grazing, forest, and orchard

FPN: For clearances of conductors of over 600 volts, see *National Electrical Safety Code*, ANSI C2-1997.

**225-19. Clearances from Buildings for Conductors of Not Over 600 Volts, Nominal.**

(a) **Above Roofs.** Overhead spans of open conductors and open multiconductor cables shall have a vertical clearance of not less than 8 ft (2.44 m) above the roof surface. The vertical clearance above the roof level shall be maintained for a distance not less than 3 ft (914 mm) in all directions from the edge of the roof.

*Exception No. 1: The area above a roof surface subject to pedestrian or vehicular traffic shall have a vertical clearance from the roof surface in accordance with the clearance requirements of Section 225-18.*

*Exception No. 2: Where the voltage between conductors does not exceed 300, and the roof has a slope of 4 in. (102 mm) in 12 in. (305 mm) or greater, a reduction in clearance to 3 ft (914 mm) shall be permitted.*

*Exception No. 3: Where the voltage between conductors does not exceed 300, a reduction in clearance above only the overhanging portion of the roof to not less than 18 in. (457 mm) shall be permitted if (1) not more than 6 ft (1.83 m) of the conductors, 4 ft (1.22 m) horizontally, pass above*

the roof overhang, and (2) they are terminated at a through-the-roof raceway or approved support.

*Exception No. 4:* The requirement for maintaining the vertical clearance 3 ft (914 mm) from the edge of the roof shall not apply to the final conductor span where the conductors are attached to the side of a building.

(b) **From Nonbuilding or Nonbridge Structures.** From signs, chimneys, radio and television antennas, tanks, and other nonbuilding or nonbridge structures, clearances — vertical, diagonal, and horizontal — shall not be less than 3 ft (914 mm).

(c) **Horizontal Clearances.** Clearances shall not be less than 3 ft (914 mm).

(d) **Final Spans.** Final spans of feeders or branch circuits to a building they supply or from which they are fed shall be permitted to be attached to the building, but they shall be kept not less than 3 ft (914 mm) from windows that are designed to be opened, doors, porches, balconies, ladders, stairs, fire escapes, or similar locations. Vertical clearance of final spans above, or within 3 ft (914 mm) measured horizontally of, platforms, projections, or surfaces from which they might be reached shall be maintained in accordance with Section 225-18.

*Exception:* Conductors run above the top level of a window shall be permitted to be less than the 3 ft (914 mm) requirement above.

Overhead branch-circuit and feeder conductors shall not be installed beneath openings through which materials may be moved, such as openings in farm and commercial buildings, and shall not be installed where they will obstruct entrance to these building openings.

(e) **Zone for Fire Ladders.** Where buildings exceed three stories or 50 ft (15.2 m) in height, overhead lines shall be arranged, where practicable, so that a clear space (or zone) at least 6 ft (1.83 m) wide will be left either adjacent to the buildings or beginning not over 8 ft (2.44 m) from them to facilitate the raising of ladders when necessary for fire fighting.

FPN: For clearance of conductors over 600 volts, see *National Electrical Safety Code*, ANSI C2-1997.

**225-20. Mechanical Protection of Conductors.** Mechanical protection of conductors on buildings, structures, or poles shall be as provided for services in Section 230-50.

**225-21. Multiconductor Cables on Exterior Surfaces of Buildings.** Supports for multiconductor cables on exterior surfaces of buildings shall be as provided in Section 230-51.

**225-22. Raceways on Exterior Surfaces of Buildings.** Raceways on exterior surfaces of buildings shall be raintight and arranged to drain.

*Exception:* Flexible metal conduit, where permitted in Section 350-5(1), shall not be required to be raintight.

**225-24. Outdoor Lampholders.** Where outdoor lampholders are attached as pendants, the connections to the circuit wires shall be staggered. Where such lampholders have terminals of a type that puncture the insulation and make contact with the conductors, they shall be attached only to conductors of the stranded type.

**225-25. Location of Outdoor Lamps.** Locations of lamps for outdoor lighting shall be below all energized conductors, transformers, or other electric utilization equipment, unless

- (1) Clearances or other safeguards are provided for relamping operations, or
- (2) Equipment is controlled by a disconnecting means that can be locked in the open position.

**225-26. Vegetation.** Vegetation such as trees shall not be used for support of overhead conductor spans.

*Exception:* For temporary wiring in accordance with Article 305.

## B. More than One Building or Other Structure

**225-30. Number of Supplies.** Where more than one building or other structure is on the same property and under single management, each building or other structure served shall be supplied by one feeder or branch circuit unless permitted in (a) through (e). For the purpose of this section, a multiwire branch circuit shall be considered a single circuit.

(a) **Special Conditions.** Additional feeders or branch circuits shall be permitted to supply the following:

- (1) Fire pumps
- (2) Emergency systems
- (3) Legally required standby systems
- (4) Optional standby systems
- (5) Parallel power production systems

(b) **Special Occupancies.** By special permission, additional feeders or branch circuits shall be permitted for

- (1) Multiple-occupancy buildings where there is no available space for supply equipment accessible to all occupants, or
- (2) A single building or other structure sufficiently large to make two or more supplies necessary.

(c) **Capacity Requirements.** Additional feeders or branch circuits shall be permitted where the capacity requirements are in excess of 2000 amperes at a supply voltage of 600 volts or less.

(d) **Different Characteristics.** Additional feeders or branch circuits shall be permitted for different voltages, frequencies, or phases, or for different uses, such as control of outside lighting from multiple locations.

(e) **Documented Switching Procedures.** Additional feeders or branch circuits shall be permitted to supply installations under single management where documented safe switching procedures are established and maintained for disconnection.

**225-31. Disconnecting Means.** Means shall be provided for disconnecting all ungrounded conductors that supply or pass through the building or structure.

**225-32. Location.** The disconnecting means shall be installed either inside or outside of the building or structure served or where the conductors pass through the building or structure. The disconnecting means shall be at a readily accessible location nearest the point of entrance of the conductors. For the purposes of this section, the requirements in Section 230-6 shall be permitted to be utilized.

*Exception No. 1: For installations under single management, where documented safe switching procedures are established and maintained for disconnection, the disconnecting means shall be permitted to be located elsewhere on the premises.*

*Exception No. 2: For buildings or other structures qualifying under the provisions of Article 685, the disconnecting means shall be permitted to be located elsewhere on the premises.*

*Exception No. 3: For towers or poles used as lighting standards, the disconnecting means shall be permitted to be located elsewhere on the premises.*

*Exception No. 4: For poles or similar structures used only for support of signs installed in accordance with Article 600, the disconnecting means shall be permitted to be located elsewhere on the premises.*

**225-33. Maximum Number of Disconnects.**

(a) **General.** The disconnecting means for each supply permitted by Section 225-30 shall consist of not more than six switches or six circuit breakers mounted in a single enclosure, in a group of separate enclosures, or in or on a switchboard. There shall be no more than six disconnects per supply grouped in any one location.

*Exception: For the purpose of this section, disconnecting means used solely for the control circuit of the ground-fault*

*protection system, installed as part of the listed equipment, shall not be considered a supply disconnecting means.*

(b) **Single-Pole Units.** Two or three single-pole switches or breakers, capable of individual operation, shall be permitted on multiwire circuits, one pole for each ungrounded conductor, as one multipole disconnect, provided they are equipped with handle ties or a master handle to disconnect all ungrounded conductors with no more than six operations of the hand.

**225-34. Grouping of Disconnects.**

(a) **General.** The two to six disconnects as permitted in Section 225-33 shall be grouped. Each disconnect shall be marked to indicate the load served.

*Exception: One of the two to six disconnecting means permitted in Section 225-33, where used only for a water pump also intended to provide fire protection, shall be permitted to be located remote from the other disconnecting means.*

(b) **Additional Disconnecting Means.** The one or more additional disconnecting means for fire pumps or for emergency, legally required standby, or optional standby system permitted by Section 225-30 shall be installed sufficiently remote from the one to six disconnecting means for normal supply to minimize the possibility of simultaneous interruption of supply.

**225-35. Access to Occupants.** In a multiple-occupancy building, each occupant shall have access to the occupant's supply disconnecting means.

*Exception: In a multiple-occupancy building where electric supply and electrical maintenance are provided by the building management and where these are under continuous building management supervision, the supply disconnecting means supplying more than one occupancy shall be permitted to be accessible to authorized management personnel only.*

**225-36. Suitable for Service Equipment.** The disconnecting means specified in Section 225-31 shall be suitable for use as service equipment.

*Exception: For garages and outbuildings on residential property, a snap switch or a set of 3-way or 4-way snap switches shall be permitted as the disconnecting means.*

**225-37. Identification.** Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, a permanent plaque or directory shall be installed at each feeder and branch-circuit disconnect location denoting all other services, feeders, or branch circuits supplying that building or structure or passing through

that building or structure and the area served by each. See Section 230-2(e).

*Exception No. 1: A plaque or directory shall not be required for large capacity multibuilding industrial installations under single management, where it is ensured that disconnection can be accomplished by establishing and maintaining safe switching procedures.*

*Exception No. 2: This identification shall not be required for branch circuits installed from a dwelling unit to a second building or structure.*

#### 225-38. Disconnect Construction.

(a) **Manually or Power Operable.** The disconnecting means shall consist of either (1) a manually operable switch or a circuit breaker equipped with a handle or other suitable operating means or (2) a power-operable switch or circuit breaker, provided the switch or circuit breaker can be opened by hand in the event of a power failure.

(b) **Simultaneous Opening of Poles.** Each building or structure disconnecting means shall simultaneously disconnect all ungrounded supply conductors that it controls from the building or structure wiring system.

(c) **Disconnection of Grounded Conductor.** Where the building or structure disconnecting means does not disconnect the grounded conductor from the grounded conductors in the building or structure wiring, other means shall be provided for this purpose at the location of disconnecting means. A terminal or bus to which all grounded conductors can be attached by means of pressure connectors shall be permitted for this purpose.

In a multisection switchboard, disconnects for the grounded conductor shall be permitted to be in any section of the switchboard, provided any such switchboard section is marked.

(d) **Indicating.** The building or structure disconnecting means shall plainly indicate whether it is in the open or closed position.

**225-39. Rating of Disconnect.** The feeder or branch-circuit disconnecting means shall have a rating of not less than the load to be carried, determined in accordance with Article 220. In no case shall the rating be lower than specified in (a), (b), (c), or (d).

(a) **One-Circuit Installation.** For installations to supply only limited loads of a single branch-circuit, the branch-circuit disconnecting means shall have a rating of not less than 15 amperes.

(b) **Two-Circuit Installations.** For installations consisting of not more than two 2-wire branch circuits, the feeder or

branch-circuit disconnecting means shall have a rating of not less than 30 amperes.

(c) **One-Family Dwelling.** For a one-family dwelling, the feeder disconnecting means shall have a rating of not less than 100 amperes, 3-wire.

(d) **All Others.** For all other installations, the feeder or branch-circuit disconnecting means shall have a rating of not less than 60 amperes.

#### 225-40. Access to Overcurrent Protective Devices.

Where a feeder overcurrent device is not readily accessible, branch-circuit overcurrent devices shall be installed on the load side, shall be mounted in a readily accessible location, and shall be of a lower ampere rating than the feeder overcurrent device.

#### C. Over 600 Volts

**225-50. Warning Signs.** Signs with the words "WARNING — HIGH VOLTAGE — KEEP OUT" shall be posted in plain view where unauthorized persons might come in contact with live parts.

**225-51. Isolating Switches.** Where oil switches or air, oil, vacuum, or sulfur hexafluoride circuit breakers constitute a building disconnecting means, an isolating switch with visible break contacts and meeting the requirements of Section 230-204(b), (c), and (d) shall be installed on the supply side of the disconnecting means and all associated equipment.

*Exception: The isolating switch shall not be required where the disconnecting means is mounted on removable truck panels or metal-enclosed switchgear units that cannot be opened unless the circuit is disconnected and that, when removed from the normal operating position, automatically disconnect the circuit breaker or switch from all energized parts.*

**225-52. Location.** A building or structure disconnecting means shall be located in accordance with Section 225-32, or it shall be electrically operated by a similarly located remote-control device.

**225-53. Type.** Each building or structure disconnect shall simultaneously disconnect all ungrounded supply conductors it controls and shall have a fault-closing rating not less than the maximum available short-circuit current available at its supply terminals.

Where fused switches or separately mounted fuses are installed, the fuse characteristics shall be permitted to contribute to the fault closing rating of the disconnecting means.