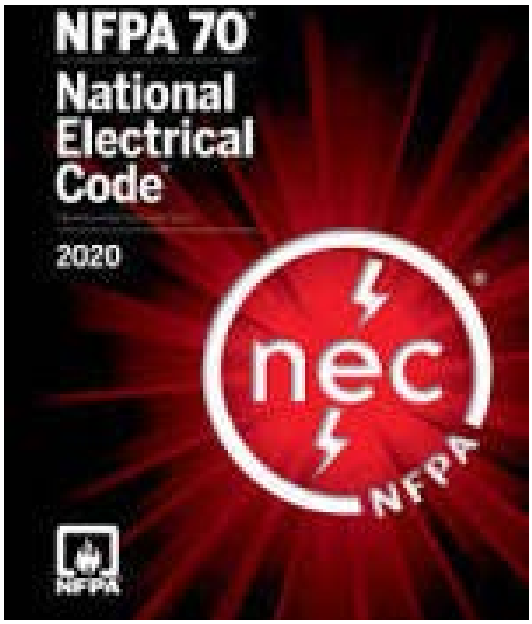
TERRY QUINN ENTERPRISE

CODES-INSTRUCTOR

2020 NEC

ILLUSTRATED CODE CHANGES
SIMPLIFIED

REVIEW
PART I, II, and III



"To the men and women of our trade,
We Build a Quality of Life, Others Take for Granted"

_____
STUDENT'S NAME

NEC Changes

90.2(A)(5) Covered
Revised: The scope of the NEC was revised to add text to indicate that the NEC does indeed pertain to installations supplying shore power to ships and watercraft in marinas and boatyards.

Comment: The scope of the NEC did not specify that installations supplying shore power to ships and watercraft in marinas and boatyards were covered by the NEC, now it does.

The 2020 NEC added a new Item number 5, to clarify that the electrical installations supplying shore power to ships and watercraft in marinas and boatyards is definitely covered by the NEC 555.

This new requirement was necessary due to a number of fatalities from electric shock associated with leakage of current from watercraft connected to shore power. There can be enough current in the water to render a person incapable of floating or swimming, which results in drowning. Human fatalities can be attributed to watercraft: connected to shore power with significant levels of current leakage creating extremely hazardous conditions. This addition to the scope of the *NEC* attempts to clarify that the *NEC* has purview over the hazards created when watercraft is connected to shore power.

A new requirement in NEC 555.35(A)(1, now requires Receptacle Providing Shore Power to boats per 555.33(A) shall have individual GFPE set to open at a **current not exceeding 30 milliamperes**.

U.S. Coast Guard studies and industry standards stated **30 milliamperes** represents an acceptable level to prevent a majority of electrical shock drowning incidents while remaining practical enough to minimize unnecessary tripping.

Also a new requirement in NEC 555.35(A)(3) now requires Feeder and Branch-Circuit Conductors installed for docking facilities shall have GFPE set to open at a **current not exceeding 100 milliamperes.**

Explanation: The ground fault sensor detects all fault current downstream from the point where it is installed. How does this help with safety? For instance, if five boats each have low level leakage to earth of 20mA, the total leakage sensed at the main circuit breaker would be 100mA, and that would trip the ground fault sensor.

100 Definitions "Part III Hazardous (Classified) Locations"
New: Definitions now has 3 parts in Article 100. Part III. "Hazardous (Classified) Locations is the newest one.

Comment: Definitions has been put into three parts.
Part I "General", Page 32. It contains definitions intended to apply wherever the terms are used throughout this Code.

Part II "Over 1000 Volts, Nominal", Page 41.
It contains definitions applicable to installations and equipment operating at over 1000 volts.

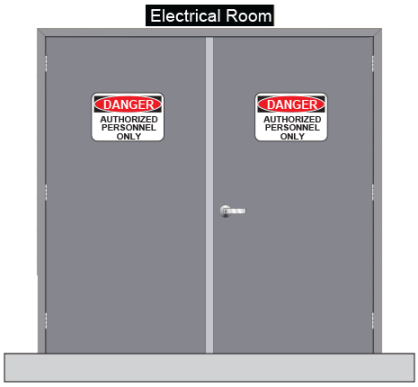
Part III, "Hazardous (Classified) Locations", Page 42.
This new addition relocated those 2020 NEC definitions with bracketed text [as applied to Hazardous (Classified) Locations] to new Part III for added clarity and usability

100 Definitions "Accessible"
Revised: Capable of being reached for operation, and inspection.

Comment: The 2017 NEC was written as: "Admitting close approach; not guarded by locked doors, elevation, or other effective means".

The 2020 NEC was revised for clarity and more closely correlate with the definition, "Readily Accessible".
The definition reads as: "Capable of being reached for operation, and inspection".

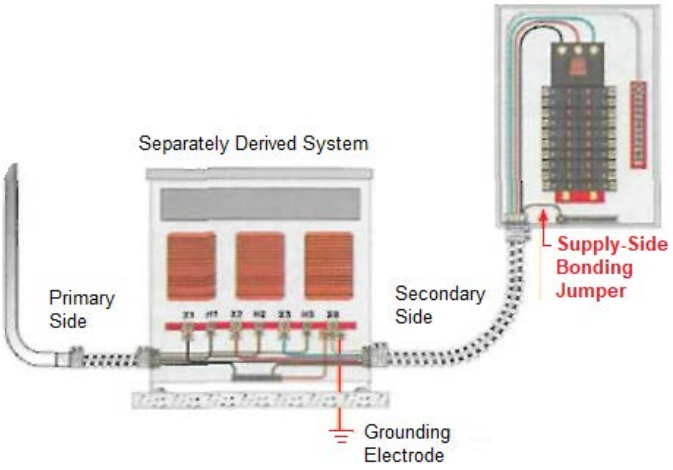
The previous definition seemed to contradict with other sections of the NEC. The definition "not guarded by locked doors" contradicts with 110.26(F) "(Locked Electrical Equipment Rooms or Enclosures". It is a common practice to lock rooms or panels when under supervised conditions.



Also the former definition stated that equipment could be considered not accessible by "elevation". Several sections of the Code, such as 110.26(A)(4) (Limited Access Working Space), 300.23 (Panels Designed to Allow Access.), and 600.21(F) (Ballasts, Transformers, Electronic Power Supplies, and Class 2 Power Sources Installed Above Suspended Ceilings) indicate equipment installed above lay-in ceilings as accessible while being "elevated." The previous definition also used the term "other effective means". This term can be considered vague and open to interpretation. The revised definition is now clear and concise.

100 Definitions "Bonding Jumper, Supply-Side"
New/Relocated: A conductor installed on the supply side of a service or within a service equipment enclosure(s), or for a separately derived system, that ensures the required electrical conductivity between metal parts required to be electrically connected. (CMP-5)

Comment: The term "supply-side bonding jumper" and its definition were first introduced in 2011 NEC.
Prior to that, there were no term "Supply-Side Bonding Jumper", this conductor was called:



This term was also introduced at 250.30(A)(2) for grounding of separately derived ac systems.

Prior to the 2011 NEC, the term "equipment bonding jumper" was used at this location and is described as a fault carrying conductor for a separately derived system.

The new definition of a supply side bonding jumper was necessary to ensure the proper identification and installation of bonding conductors.

NOTE: Articles 100-110 states, that within or on the supply side of the service equipment and between the source of a separately derived system and the first disconnecting means. An equipment bonding jumper completing the equipment grounding conductor path and are installed on the load side of the overcurrent device and are sized from Table 250.122 based upon the rating of the overcurrent protective device.

Whereas, the size of a supply side bonding jumper is installed on the line or supply side of an overcurrent device and are sized by 250.102(C) from Table 250.102(C)(1) and the 12.5 percent rule. As a result, these terms could not be combined in one definition.

Supply-side bonding jumper provides electrical continuity between the supply source (such as the utility transformer enclosure) and the various enclosures of the service equipment. It connects bonding bushings (where used) to service grounded (neutral) conductor in service equipment enclosure(s). It carry ground-fault current from ground faults that occur on the supply side of the main overcurrent protection and provide a low impedance path for the ground-fault current to return to the source of the electrical system. Supply-side bonding jumpers can be non-flexible metal raceway or a wire type conductor. Service grounded conductor can sometimes also serve as the supply-side bonding jumper.

100 Definitions "Dormitory Unit"
New: A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities.

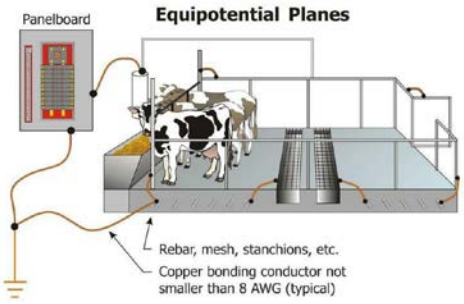
Comment: A new definition for a "Dormitory Unit" was introduced at Article 100.
The term "dormitory unit" or "dormitories" was used (8) times in (4) different articles in the 2017 *NEC* and (9) times in the 2020 NEC. This term needed to be defined in order to promote consistency with enforcement and interpretation of the requirements for such things as GFCI requirements and tamper-resistant receptacles in dormitories.

Without this definition, installers and inspectors alike could interoperate a variety of locations, such as a bunkhouse, a cabin at church camp, a summer-cabin, or homeless shelters, as a dormitory unit.

This could require unnecessary requirements, like arc-fault circuit interrupter (AFCI) protection per 210.12(B), or Tamper-resistant receptacles per 406.12(7), which are required for dormitory units.

Applying this new definition, will greatly aid in determining what a dormitory unit is and what is not. NOTE: The new definition does not specifically reference the Words College, university, or school. While a dormitory unit can certainly be found at a typical college campus, a dormitory unit is not limited to a learning institution.

100 Definitions "Equipotential Plane"
Revised and Relocation: Accessible conductive parts bonded together to reduce voltage gradients in a designated area.



Comment: The definition for "Equipotential Plane was relocated from 682.2 "Natural and Artificially Made Bodies of Water" and moved to Article 100. Per 2017 NEC there were two similar definitions that were mentioned in the code. One was in Article 547, "Agricultural Buildings" and the other was Article 680.26 is Swimming Pools".

The previous text concerning conductive elements in or under walking surfaces was considered to be a requirement located in a definition and was moved to 682.33(C) (Equipotential Planes and Bonding of Equipotential Planes-Walking Surfaces).

It should be noted that the definition for "Equipotential Plane is: "An area where wire mesh or other conductive elements are embedded in or placed under concrete, bonded to all metal structures and fixed nonelectrical equipment that could become energized, and connected to the electrical grounding system to minimize voltage differences within the plane and between the planes, the grounded equipment, and the earth".

100 Definitions "Fault Current"
New: The current delivered at a point on the system during a short-circuit condition.

100 Definitions "Available Fault Current"
New: The largest amount of current capable of being delivered at a point on the system during a short-circuit condition.

Informational Note: A short-circuit can occur during abnormal conditions such as a fault between circuit conductors or a ground fault. See Informational Note.

Comment: The 2017 NEC used the term "maximum available fault current" and "maximum available short-circuit current. The word "maximum" was deleted from the 2020 NEC code.

100 Definitions "Free Air (As applied to conductors)
New: Open or ventilated environment that allows for heat dissipation and air flow around an installed conductor.

Comment: A new definition for "Free Air (as applied to conductors)" was added to Article 100. The 2017 NEC used the term "Free Air" 22 times throughout the Code. But they were not defined.

The 2020 NEC still use the term "Free Air" throughout the code but a new definition of "Free Air" was added to the 2020 NEC in Article 100.

This definition makes it clear that contact or close proximity with additional conductors or other materials that could impede the flow of heat away from the conductor shall not be allowed. It should be noted that the term "free air" is used in three tables, Table 310.17, Table 310.19, and Table 310.21.

100 Definitions "Habitable Room"
New: A room in a building for living, sleeping, eating, or cooking, but excluding bathrooms, toilets rooms, closets, hallways, storage or utility spaces, and similar areas.

Comment: Per the 2017 NEC, the terms "nonhabitable room" or "habitable room(s)" appeared eight times throughout the Code. There was no definition of the term "habitable room". These terms still appear in the 2020 NEC, but a definition for "Habitable Room" was added to Article 100.

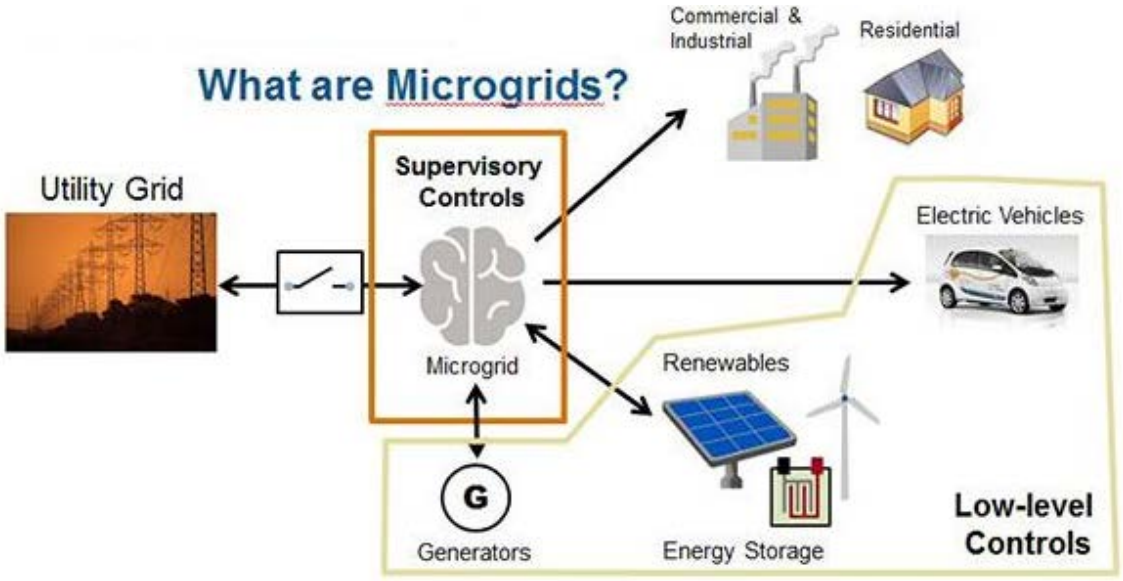
NOTE: This definition aligns with the same term that is used in NFPA 5000, Building Construction and Safety Code and promotes consistency of its use. This will add clarity to the Code for both the installer and AHJ. Requirements such as 210.8 {GFCI requirements for dwelling units), 210.70(A)(1) {lighting outlets for dwelling units), 210.70(B) {lighting outlets for guest rooms and guest suites in hotels, motels, or similar occupancies), 300.22(C) {other spaces used for environmental air), and 404.2(C) {grounded conductor at switches controlling lighting loads) can be easily be applied.

100 Definitions “Island Mode”

New: The operational mode for stand-alone power production equipment or an isolated microgrid, or for a multimode inverter or an interconnected microgrid that is disconnected from an electric power production and distribution network primary power source

Comment: A new definition for "Island Mode" primarily related to microgrid systems and stand-alone systems was added to Article 100. The 2017 NEC, "Island Mode" was referred to as “Stand-alone System”. The 2020 NEC “Island Mode” replaced the term “Stand-alone System” with "Island Mode".

A stand-alone (or island mode) microgrid is one that does not connect to the utility grid but instead operates in an island mode at all times typically for economic issues or geographical locations.



100 Definitions “Labeled Informational Note”

New: Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

Informational Note: If a listed product **is** of such **a** size, shape, material, or surface texture that it is not possible to apply legibly the complete label to the product, the complete label may appear on the smallest **unit** container in which the product **is** packaged

Comment: There are several types of electrical equipment addressed in the NEC that are required to not only be "Listed”, but also required to be "Labeled”. The labeling of listed equipment is not always possible; in some cases the products are too small to be labeled or the environmental conditions are too great.

A typical wire nut for splicing conductors is required to be listed and labeled, but they are one of those products that are too small to affix a label. Using the smallest of the shipping package will service as the product marking or labeling.

100 Definitions "Reconditioned"
New: Electromechanical systems, equipment, apparatus, or components that are restored to operating conditions. This process differs from normal servicing of equipment that remains within a facility, or replacement of listed equipment on a one-to-one basis.

Comment: A new definition for "Reconditioned" was added to Article 100 and an informational note added to indicate that the term reconditioned is frequently referred to as rebuilt, refurbished, or remanufactured.

The 2017 NEC first referenced "Reconditioned Equipment" in 110.21(A)(2) and 110.3(A)(1), but there was no definition in Article 100.

The 2020 NEC retained the reconditioned equipment section in Article 110 and a new definition for "Reconditioned was added to Article 100.

110.3(B) Examination, Identification, Installation "Installation and Use"
Revised: Equipment that is listed, labeled, or both shall be installed and used in accordance with any instructions included in the listing or labeling.

Comment: Listing requirements were modified for clarity and usability to address equipment that is listed, labeled, or both. The 2017 NEC requirement equipment to be listed or labeled and installed and used in accordance with any instructions included in the listing or labeling.

The 2020 NEC requires the equipment that is listed, labeled **or both** are now required to be installed and used in accordance with any instructions included in the listing or labeling.

Note: The word "listed" and the word "labeled" are used over 1000 times in the NEC. Per the 2020 NEC, the rationale for the revision was simple, to provide information to the AHJ regarding the suitability of equipment they encounter.

110.12(C) Mechanical Execution of Work (Cables and Conductors)
New: Cables and conductors installed exposed on the surfaces of ceilings and sidewalls shall be supported by the building structure in such a manner that the cables and conductors will not be damaged by normal building use. Such cables and conductors shall be secured by hardware including straps, staples, cable ties, hangers, or similar fittings designed and installed so as not to damage the cable. The installation shall also conform to 300.4 and 300.11. Nonmetallic cable ties and other nonmetallic cable accessories used to secure and support cables in other spaces used for environmental air (plenums) shall be listed as having low smoke and heat release properties.

Comment: This new section was added to consolidate the mechanical execution of work and provide better understanding and end the redundant in the Chapter 7 and 8. This action resulted in the deletion of 725.24, 760.24, 770.24, 800.24, 820.24, 830.24, and 840.24 which all dealt with "Mechanical Execution of Work" requirements.

NOTE 1: Read Informational Note No. 1, 2 and 3 for more clarity.
NOTE 2: See NEC 30.11(C), Item 1, 2, and 3. Raceways used as Means of Support.

Cable Support System
NOTE: Always refer to the NEC

No.	Descriptions	Support Method All must be Listed	2020 NEC
1	MV Cable (Medium Voltage Conductors and Cable)	Cable Ties	311.40
		Metallic Supports	
2	AC Cable (Armored Cable)	Staple	320.30(A)
		Cable Ties	
		Straps	
		Hangers	
		or Similar Fitting	
3	FC Cable (Flat Cable)	Special Design	322.30
4	FCC Cable (Flat Conductor Cable)	Adhesive	324.30
		Mechanical Anchoring Identified for this uses.	
		or Similar Fitting	
5	Type IGS (Integrated Gas Spacer Cable)	Supported in Conduit	326.116
6	MC Cable (Metal-Clad Cable)	Staple	330.30(A)
		Cable Ties	
		Straps	
		Hangers	
		or Similar Fitting	
7	MI Cable (Mineral-Insulated-Metal	Staple	332.30
	Sheathed Cable)	Straps	
		Hangers	
		or Similar Fitting	
8	NM Cable (Nonmetallic-Sheathed Cable)	Staple	334.30
		Cable Ties	
		Straps	
		Hangers	
		or Similar Fitting	
9	TC (Power and Control Tray Cable)	Cable Tray	336.10 Item 7
10	SE and USE (Service-Entrance Cable)	Support IAW 334,.30	338.10(B)(4)(b)(1)
11	UF Cable (Underground and Branch-	Install IAW Part II & III	340.10 Item 4
	Circuit Cable)	334.30.	

Conduit Support System
NOTE: Always refer to the NEC

No.	Descriptions	Support Method	2020 NEC
1	IMC (Intermediate Metal Conduit)	Secure within 3 feet of box	342.30(A) & (B)
		Secure within 5 feet of box if	
		Structural not readily permit.	
		Distance between support	T-344.30(B)(2)
		Listed Support	110.3(B)
2	RMC (Rigid Metal Conduit)	Secure within 3 feet of box	344.30
		Secure within 5 feet of box if	
		Structural not readily permit.	
		Distance between support	T-344.30(B)(2)
		Listed Support	110.3(B)
3	FMC (Flexible Metal Conduit)	Secure within 12 Inches of box	348.30(A)(B)
		Secure 4 ½ feet Intervals	
		Listed Support	110.3(B)
4	LFMC (Liquid tight Flexible Metal Conduit)	Secure within 12 Inches of box	350.30(A)(B)
		Secure 4 ½ feet Intervals	
		Listed Support	110.3(B)
5	PVC (Rigid Polyvinyl Chloride Conduit)	Secure within 3 feet of box	352.30
		Distance between support	T-352.30
		Listed Support	110.3(B)
6	HDPE (High Density Polyethylene Conduit)	Direct Burial	353.10
7	NUCC (Nonmetallic Underground Conduit	Direct Burial	354.10
	with Conductors)		
8	RTRC (Reinforced Thermosetting Resin	Secure within 3 feet of box	355.30(A)(B)
	Conduit)	Distance between support	T-355.30
		Listed Support	
9	LFNC (Liquid tight Flexible Nonmetallic	Secure within 12 Inches of box	356.30 Item 1-4
	Conduit)	Secure 3 feet Intervals	
		Listed Support (Cable Ties)	110.3(B)
10	EMT (Electrical Metallic Tubing	Secure within 3 feet of box	358.30(A)
		Secure within 5 feet of box if	358.30(B)
		Structural not readily permit.	
		Distance between support	358.30(A)
		Listed Support	110.3(B)
11	ENT (Electrical Nonmetallic Tubing	Secure within 3 feet of box	362.30(A)
		Secure not more than 6 feet	362.30(B) Ex. 1
		From Luminaire	
		Distance between support (3 Ft)	362.30(A)
		Listed Support	110.3(B)

110.14(D) Electrical Connections, Terminal Connection Torque

Revised: Tightening torque values for terminal connections shall be as indicated on equipment or in installation instructions provided by the manufacturer. An approved means shall be used to achieve the indicated torque value.

New: Informational Note No. 1: Examples of approved means of achieving the indicated torque values include torque tools or devices such as shear bolts or breakaway-style devices with visual indicators that demonstrate that the proper torque has been applied.

New: Informational Note No. 2: The equipment manufacturer can be contacted if numeric torque values are not indicated on the equipment or if the installation instructions are not available. Informative Annex I of UL Standard 486A-486B, Standard for Safety-Wire Connectors, provides torque values in the absence of manufacturer's recommendations.

New: Informational Note No. 3: Additional information for torqueing threaded connections and terminations can be found in Section 8.11 of NFPA 70B-2019, Recommended Practice for Electrical Equipment Maintenance.

Comment: Torquing requirements were first introduced into the 2017 NEC. There was nothing new about torquing requirements; it has been a requirement of manufacturer's specifications for years.

The 2020 NEC new revisions place proper emphasis on achieving the required torque values rather than the tool used to achieve such values. Three new informational notes were added to provide insight into correct torqueing values.

NOTE: What brought this about: The additions of 110.14(D) were an attempt to simply state that the torquing needed to be achieved with a tool designed for that purpose, rather than focusing on achieving the proper torqueing tool itself. The rule was being manipulated by some in the electrical industry by putting more emphasis on the torquing tool and not achieving the recommended torque value. When examining the torqueing rule, some choose to place the emphasis on keeping the torque tool "calibrated" more than the unquestioned need for maintaining torque values on the conductors and termination itself.

110.21(A)(2) Reconditioned Equipment

Revised: Reconditioned equipment shall be marked with name, trademark, or other descriptive marking by which the organization responsible for reconditioning the electrical equipment can be identified, along with the date of the reconditioning.

Reconditioned equipment shall be identified as “reconditioned” and the original listing mark removed. Approval of the reconditioned equipment shall not be based solely on the equipment’s original listing.

Exception: In industrial occupancies, where conditions of maintenance and supervision ensure that only qualified persons service the equipment, the markings indicated in 110.21(A)(2) shall not be required for equipment that is reconditioned by the owner or operator as part of a regular equipment maintenance program.

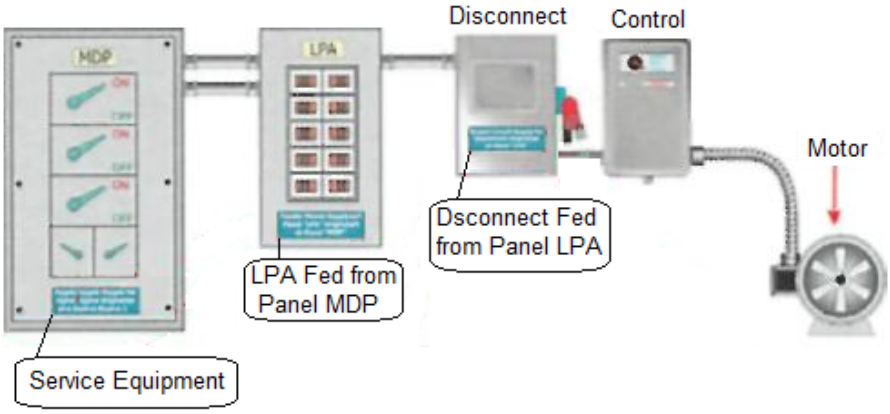
Comment: This revision made it clear that the **original mark shall be removed** if the equipment is reconditioned and **be identified** as “Reconditioned”. The exception allows the equipment to be reconditioned without marking it with “reconditioned”, where conditions of maintenance and supervision ensure only qualified persons service equipment.

NOTE: The term “reconditioned” may be interchangeable with “Rebuilt”, “Refurbished”, or “Remanufactured” per Information Note No. 2 of 110.21(A).

110.22(A) Identification of Disconnecting Means

Revised: Each disconnecting means shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident. In other than one or two-family dwellings, the marking shall include the identification of the circuit source that supplies the disconnecting means. The marking shall be of sufficient durability to withstand the environment involved.

Comment: Disconnecting means are required to be marked with a label to identify its uses. If the disconnect is located next to something (electrical equipment, etc) that makes it obvious of its purposes, no label will be required. Also the label or marking shall be suitable for the environment. This will bring in the same requirement as that of 408.4(B) for switchboards, switchgear, and panelboards identification.



110.24(A) Available Fault Current "Field Marking"

New: Service equipment at other than dwelling units shall be legibly marked in the field with the available fault current. The field marking(s) shall include the date the fault current calculation was performed and be of sufficient durability to withstand the environment involved. The calculations shall be documented and made available to those authorized to design, install, inspect, maintain, or operate the system.

Information Note No. 2: Values of available fault current for use in determining appropriate minimum short-circuit current and interrupting ratings of service equipment are available from electric utilities in published or other forms.

Comment: A new informational note was added to advise of the available fault current for use in determining appropriate minimum short circuit current ratings of service equipment are available from electric utilities in published or other forms.

Available Fault Current Label, Field Applied

Manufacture Rating Label Factory Applied

Arc Flash & Shock Hazard Label Field Applied

110.21(B) Field -Applied Hazard Marking

Review: Where caution, warning, or danger signs or labels are required by this Code, the Labels shall meet the following requirements.

Comment: Section 110.21(B) applies to **caution, warning** and **danger signs**, such as the danger sign requirement in 110.34(C) for High Voltage. NEC 110.24(A) pertains to field marking certain equipment with the maximum available fault current. Also all field markings shall be of sufficient durability to withstand the environment.

110.26(C)(2) Entrance to and Egress from Working Space "Large Equipment"

Revised: For large equipment that contains overcurrent devices, switching devices, or control devices, there shall be one entrance to and egress from the required working space not less than 24-inches wide and 6 ½ feet high at each end of the working space. This requirement shall apply to either of the following conditions.

(1) For equipment rated 1200 amperes or more and over 6-feet wide.
(2) For service disconnecting means installed in accordance with 230.71 where the combined ampere rating is 1200 amperes or more and over 6-feet wide.

Open equipment doors shall not impede the entry to or egress from the working space.

A single entrance to and egress from the required working space shall be permitted where either of the conditions in 110.26(C)(2)(a) or (C)(2)(b) is met.

(a) **Unobstructed Egress.** Where the location permits a continuous and unobstructed way of egress travel, a single entrance to the working space shall be permitted.

(b) **Extra Working Space.** Where the depth of the working space is twice that required by 110.26(A) (1), a single entrance shall be permitted. It shall be located such that the distance from the equipment to the nearest edge of the entrance is not less than the minimum clear distance specified in Table 110.26(A)(1) for equipment operating at that voltage and in that condition

Comment: In the 2017 NEC, the term "Large Equipment" was described as electrical equipment over 6-foot wide and also being rated 1200 amperes or more that contains OCPDs. Why is this important? Because of the EGRESS requirements to get out of the Working Space during an emergency.

Per the 2020 NEC, section 110.26(C)(2) the requirement for the 1200 amperes or more and the over six-foot for one piece of electrical equipment was changed. Now the combined amperes and the combined measurement of all the service disconnecting means per NEC 230.71 will be added together individually, and if the combined amperes are 1200 amperes or more and the equipment is more than 6-feet measure wide, the installation will be considered "Large Equipment

110.26(C)(3) Entrance to and Egress from Working Space "Personnel Door"

Revised/New: (3) Personnel Doors. Where equipment rated 800 amperes or more that contains overcurrent devices, switching devices, or control devices is installed and there is a personnel door(s) intended for entrance to and egress from the working space less than 7.6 m (25 ft) from the nearest edge of the working space, the door(s) shall open in the direction of egress and be equipped with listed panic hardware or listed fire exit hardware.

Informational Note: For information on panic hardware, see UL 305, Standard for Safety for Panic Hardware. For fire exit hardware, see UL 305, Standard for Panic Hardware, and UL 10C, Standard for Safety for Positive Pressure Fire Tests of Door Assemblies.

Comment: The 2017 NEC, required entrance/egress personnel doors to be equipped with "listed panic hardware".

The 2020 NEC now allows these doors to be equipped with "**listed panic hardware** or **listed fire exit hardware**."

A new informational note was also added at 110.26(C)(3) giving additional information to the user of the *Code* on panic hardware and fire exit hardware.

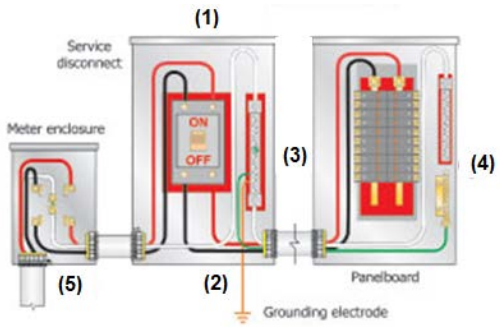
Adding listed fire exit hardware as an alternative to listed panic hardware will correlate with the terminology used in the building and fire codes. Panic hardware is used for egress doors installed in a non-fire-resistance rated wall. Fire exit hardware is used for egress doors installed in a fire-resistance rated wall.

Any personnel door intended for entrance to and egress from the working space that is located less than 25 feet from the nearest edge of the working space for a piece of electrical equipment rated 800 amperes or more are required to open in the direction of egress.

200.3 Connection to Grounded System

Revised: Grounded conductors of premises wiring systems shall not be electrically connected to the supply system grounded conductor to ensure a common, continuous grounded system. For the purpose of this section, **electrically connected** shall mean making a direct electrical connection capable of carrying current, as distinguished from induced currents.

Exception: Listed interactive inverters identified for use in distributed resource generation systems such as photovoltaic and fuel cell power systems shall be permitted to be connected to premises wiring without a grounded conductor if the connected premises wiring or utility system includes a grounded conductor.



1. Grounded conductor brought to the service disconnecting means enclosure.
2. Grounded to a grounding electrode system.
3. Grounded conductor is bonded to the service disconnecting means enclosure with a main bonding jumper.
4. Feeder and branch circuit grounded (neutral) conductor kept insulated from grounding connection on the load side of the service disconnection means.
5. Grounded conductor used for grounding and bonding on the line side of the service disconnecting means.

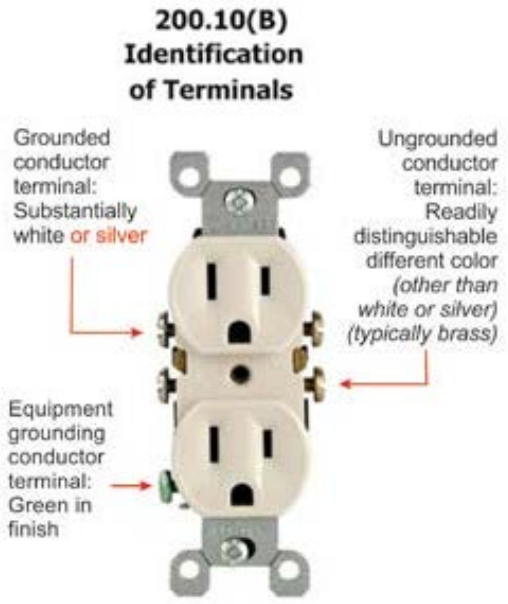
Comment: The 2017 NEC, section 200.3 stated that "premises wiring shall not be electrically connected to a supply system unless it contained an “Interior” grounded conductor.

The 2020 NEC, was revised, making it clear that all premises wiring system, not just interior wiring are required to be electrically connected to the supply system grounded conductor.

200.10(B)(1) Identification of Terminals “Receptacles, Plugs, and Connectors”

Revised: Grounded conductors Receptacles, polarized attachment plugs, and cord connectors for plugs and polarized plugs shall have the terminal intended for connection to the grounded conductor identified as follows:

(1) Identification shall be by a metal or metal coating that is substantially white or silver in color or by the word white or the letter W located adjacent to the identified terminal.



(2) If the terminal is not visible, the conductor entrance hole for the connection shall be colored white or marked with the word white or the letter W.

Informational Note: See 250.126 for identification of wiring device equipment grounding conductor terminals.

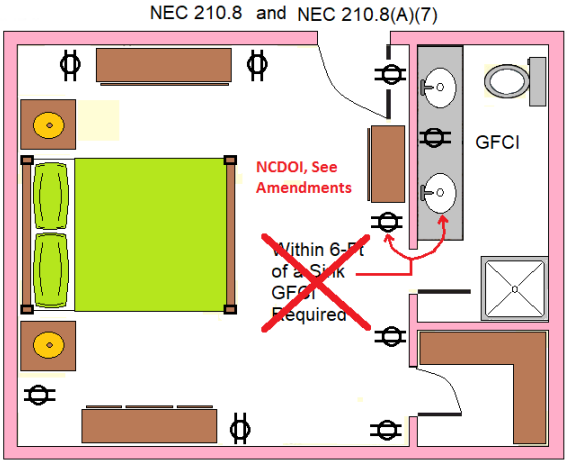
Comment: Per the 2017 NEC, the terminals intended for the connection of the grounded conductor was identified by a metal or metal coating that is substantially white in color".

Per the 2020 NEC, the terminals intended for the connection of the grounded conductor was identified by a metal or metal coating that is substantially "white or silver" in color.

210.8 Ground-Fault Circuit-Interrupter Protection for Personnel. (See NCDOI Amendments)
Revised: Ground-fault circuit-interrupter protection for personnel shall be provided as required in 210.8(A) through (F). The ground-fault circuit interrupter shall be installed in a readily accessible location.

Informational Note No. 1: See 215.9 for ground- fault circuit-interrupter protection for personnel on feeders.
Informational Note No. 2: See 422.5(A) for GFCI requirements for appliances.
Informational Note No. 3: See 555.9 for GFCI requirements for boat hoists.'

Informational Note No. 4: Additional GFCI requirements for specific circuits and equipment are contained in Chapters 4, 5, and 6.



For the purposes of this section, when determining the distance from receptacles, the distance shall be measured as the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, ceiling, or fixed barrier, or the shortest path without passing through a ~~door, doorway, or~~ window.

Comment: The 2017 NEC, allowed the measurements from receptacles to objects {such as a sink), were measured as the "**shortest path**" a cord of an appliance connected to a receptacle would take without piercing a floor, wall, ceiling, or fixed barrier, or passing through a door, doorway, or window.

The 2020 NEC, now measurement through the cabinet door, it is no longer prohibited (its allowed). The issue was the word "**door and doorway**". The question is what is a door? If you were to asked if a kitchen cabinet door is a door, you would most likely say yes, it's a door. But that was not what CMP-2 intended. The receptacle that has raised the most questions for GFCI protection has been the receptacle located underneath the kitchen sink that serve the garbage disposal.

NCDOI Amendments: DOI put Doors or Doorway back, in excluding cabinet doors.

210.8(A) Dwelling Units (Ground-Fault Circuit-Interrupter Protection for Personnel)
Revised: All 125-volt through 250-volt ~~single-phase, 15 and 20 ampere~~ receptacles installed in the locations specified in 210.8(A)(1) through ~~(10)~~ (11) and supplied by single-phase branch circuits rated 150 volts or less to ground shall have ground-fault circuit-interrupter protection for personnel.

Comment: Comment: GFCI for dwelling was first introduced in the 1971 NEC and was in section 210-22(d) for 15- and 20-ampere receptacles installed outdoors.

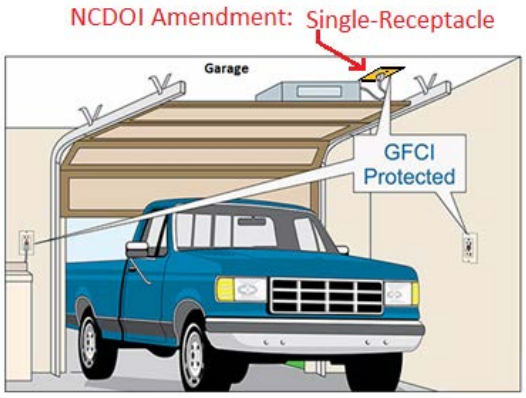
Now the requirement for dwelling units GFCI has led to eleven specific locations at dwelling.

GFCI protection for dwelling units has was limited to 125-volt, single-phase, 15- and 20-ampere.In the 2020 NEC, it has expanded GFCI protection to all 125-volt through 250-volt receptacles, supplied by single-phase branch circuits rated 150 volts or less to ground, with no maximum ampere rating.

210.8(A)(1) Bathroom (Ground-Fault Circuit-Interrupter Protection for Personnel
Review: Bathroom

Comment: All receptacles located in bathrooms of dwelling units shall be GFCI protected.
Also see: NEC 210.11(C)(3) and 210.52(D)

210.8(A)(2) Garage (Ground-Fault Circuit-Interrupter Protection for Personnel
Revised: Garages, and also accessory buildings that have a floor located at or below grade level not intended as habitable rooms and limited to storage areas, work areas, and areas of similar use.



Comment: Any receptacles rated 125 volts through 250-volts that is supplied by single-phase branch circuits rated 150 volts or less to ground and installed in a dwelling unit garage will now require GFCI protection for personnel.

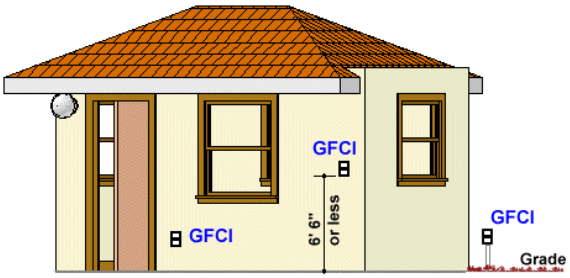
There are no exceptions. Regardless of where the receptacle is located in the garage, or what appliance or equipment it supported, this includes garage door opener.

See NCDOI Amendment to NEC 210.8(A)(2);
NCDOI added an exception to 210.8(A)(2). The exception reads as follows:

"Exception to (2): Single or duplex receptacles that are located more that 2.44 (8 ft) above the floor and specifically for connection to permanently installed cord-–plug garage door openers. A duplex receptacle shall only be permitted under this exception where two cord-and plug garage door openers utilize both contact devices of the duplex receptacle."

Comment: This means, only a single outlet receptacle is allow for each garage door opener(s), excepted a duplex receptacle is allowed when two cord-and-plug connected garage door openers are connected to the duplex at the same time..

210.8(A)(3) Outdoor (Ground-Fault Circuit-Interrupter Protection for Personnel)
Review: Outdoors.
Exception to (3): Receptacles that are not readily accessible and are supplied by a branch circuit dedicated to electric snow-melting, deicing, or pipeline and vessel heating equipment shall be permitted to be installed in accordance with 426.28 or 427.22, as applicable.



Outdoor Receptacles, GFCI proection
NEC 210.8(A)(3) and NEC 210.52(E)(1)(2)(3)

Comment: All 125 volts through 250 volts receptacles installed outdoor shall be GFCI receptacles.

NOTE: Slump Pumps are required to be GFCI protected, See NEC 422.5(A)(6). **Sewer Pumps** are not required per NCDOI. An amendment to the NEC is put out every code cycle, and Sewer Pumps is exempt from GFCI protection, but receptacles must be an **single**-receptacle outlet..

210.8(A)(4) Crawl Space (Ground-Fault Circuit-Interrupter Protection for Personnel)
Review: at or below grade level.

Comment: Receptacles must be **GFCI protected** where located within **crawl spaces**. Regardless of where the receptacle is located, it must be **GFCI protected.**

Note 1: GFCI protection is also required for all lighting outlets per NEC 210.8(C) in crawl spaces.
Note 2: Receptacles could be installed outside the **crawl space** if located on the same level and within 25 feet of the equipment. See NEC 210.63.

210.8(A)(5) Basement (Ground-Fault Circuit-Interrupter Protection for Personnel
Revised: Basement

Exception to (5): A receptacle supplying only a permanently installed fire alarm or burglar alarm system shall not be required to have ground-fault circuit-interrupter protection.

Informational Note: Sec 760.41(B) and 760.121(B) for power supply requirements for fire alarm systems.
Receptacles installed under the exception to 210.8(A)(5) shall not be considered as meeting the requirements of 210.52(G).

Comment: Basements are no longer a judgment call to determine whether or not a basement is "**unfinished**". The GFCI requirements is for all receptacles in **both unfinished and finished basement.**

NOTE: As of right now the lights in the basement is not required to be GFCI protected.

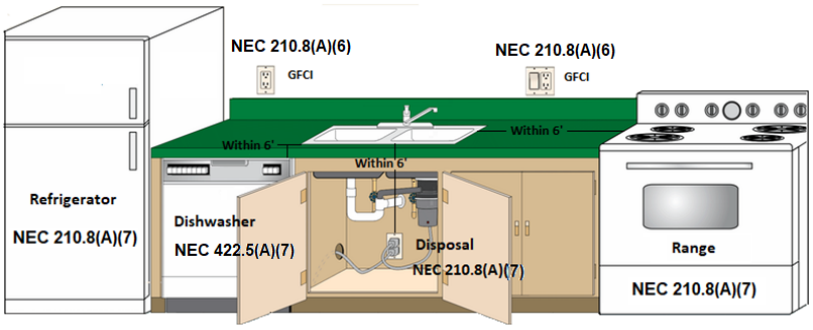
NCDOI Amendment to NEC 210.8(A)(5): Unfinished portions of areas of the basement not intended as habitable rooms.


Unfinished Basement


Finished Basement

210.8(A)(7) Sinks (Ground-Fault Circuit-Interrupter Protection for Personnel)

Revised: Where receptacle are installed within 1.8 m (6 ft) from the top inside edge of the bowl of the sink.



Comment: The receptacles serving the Disposal, Ranges, Oven, Refrigerator and Microwave, will now require GFCI protection if within 6 within **six feet** of the kitchen sink. The **Dishwasher** requires GFCI protection even if it was more than 6 feet away from a sink. See 422.5(A)(7).

Refrigerator: When a refrigerator receptacle is located within 6-feet of the outside edge of the kitchen sink, GFCI protection is required, even if the receptacle is located **behind** the refrigerator. If refrigerator receptacle is more than 6-feet from the edge of a sink, GFCI is not required.

210.8(A)(10) Laundry Room (Ground-Fault Circuit-Interrupter Protection for Personnel)

New: Exception to (1) through (3), (5) through (8), and (10): *Listed locking support and mounting receptacles utilized in combination with compatible attachment fittings installed for the purpose of serving a ceiling luminaire or ceiling fan shall not be required to be ground-fault circuit-interrupter protected. If a general-purpose convenience receptacle is integral to the ceiling luminarie or ceiling fan, GFCI protection shall be provided.*

Comment: A new exception was added due to the new type of locking type receptacles designed for lighting fixtures and ceiling fans, or the combination of both. It applies to (1) Bathrooms; (2) Garage; (3) Outdoors; (5) Basement; (6) Kitchens; (7) Sinks: (8) Boathouses; (10 Laundry Areas.

What is a locking type receptacle? The one in the picture is one type that is approved by the NEC. The locking support and mounting receptacle is generally located on ceiling or high on walls where readily accessible is not available. These receptacles are not designed for used with flexible cords and attachment plugs, so GFCI is **NOT** required. But any locking type receptacles that supply cord and plug connected equipment must be GFCI protected. The Manufactory for the locking type receptacles in the pictures is: Safety Quick Lighting and Fan Corp

210.8(A)(11) Indoor Damp and Wet location (Ground-Fault Circuit-Interrupter Protection for Personnel)

New: Indoor damp and wet location

Comment: This item is **NEW** to 210.8(A). It states, GFCI protection is required for all 125-volt through 250-volt receptacles, single-phase, rated 150 volts or less to ground, that are installed in an indoor damp or wet location regardless of sink, bathtub, or shower in these areas.

Under this new ruling all areas that are considered indoor damp and wet location will require all receptacles to be GFCI protected. This could be a bathroom, walk in shower room, mud room, animal wash down room, with or without sink, etc. The 6-foot rule for a receptacle from a sink does not apply in this new change.

There is **NO** clear interpretation, only the definitions for Damp, Wet, or Dry Location, found in Article 100.

Also, who determines if a location is a damp, wet, or dry location, the authority having jurisdiction (AHJ).

210.8(B) Other Than Dwelling Units

Revised: All 125-volt through 250-volt receptacles supplied by single-phase branch circuits rated 150 volts tor less to ground, 50 amperes or less, and all receptacles supplied by three-phase branch circuits rated 150 volts or less to ground, 100 amperes or less, installed in the locations specified in 210.8(B)(10 through (B)(12) shall have ground-fault circuit-interrupter protection of personnel.

Comment: Non-Dwelling units GFCI protection has be expanded just as in the dwelling unit. But unlike in the dwelling unit where there are no amperage limitations for the circuits. The non-dwelling units has a amperage limitation. It is 50-amps or less for single-phase circuits and 100-amps or less for three-phase. All branch circuits are 150-volt to ground.

NOTE: What happens if the branch circuits are rate more than 100 amperes. Then its not required to be GFCI. Also, the branch circuits are rated IAW the maximum permitted ampere rating or setting of the overcurrent device. NEC 210.18

210.8(B)(2) Kitchens (Other Than Dwelling Units)

Revised: Kitchens or areas with a sink and permanent provisions for either food preparation or cooking.

Comment: In the 2017 NEC, a business like an **Ice cream parlor** or a **coffee shop** did not require GFCI protection. Most of these businesses do not have a stove or an oven. But they have stainless steel refrigerators and freezers that are often used as countertops that can be used for food preparation. The NEC at that time did not requires GFCI protection.

Moisture and condensation can be generated from these equipment's, and a potential shock hazard could occur. Now 2020 NEC requires GFCI protection in these areas. Additional language was added to clarify that non-dwelling unit with a sink and permanent provisions for food preparation only has the same potential shock hazards as a kitchen.

210.8(B)(6) Indoor Damp and Wet Locations (Other Than Dwelling Units)

Revised: Indoor damp and wet location.

Comment: Any area that is identified as an indoor damp or wet location will now be GFCI protected.

210.8(B)(11) Laundry Room (Other Than Dwelling Units)
Revised: Laundry areas.

Laundromat

Comment: This new item (11) was added to require GFCI protection for receptacles installed in non-dwelling unit laundry areas. The 2014 NEC added this requirement for dwelling unit laundry areas, but did not address non-dwelling facilities.

Most condominiums and apartment complexes provide a common laundry building or area as a convenience to the tenants. Laundry areas typically involve electrical appliances and the presence of water with an increased risk of electric shock hazards. The 2020 NEC now requires non-dwelling Laundry Room to be GFCI.

210.8(B)(12) Bathtubs and Shower Stalls (Other Than Dwelling Units)
New: Bathtubs and shower stalls – where receptacles are installed within 1.8 m (6 ft) of the outside edge of the bathtub or shower stall.

Comment: This new item (12) was added to provide GFCI protection for receptacles installed within 6-feet of the outside edge of a non-dwelling unit bathtub or shower stall.

Locker rooms and showers are already protected in 210.8(B)(7). Locker rooms and showers were put into the 2014 NEC.

210.8(D) Specific Appliances (Dishwasher)
Relocated: Unless GFCI protection is provided in accordance with 422.5(B)(3) through (B)(5), the outlets supplying the appliances specified in 422.5(A) shall have GFCI protection in accordance with 422.5(B)(1) or (B)(2).

Dishwasher Commercial

Dishwasher Domestic

Comment: During the 2014 NEC, a new rule 210.8(D) was added, requiring GFCI protection for all outlets that supply dishwashers installed in dwelling units. This included receptacle outlet and hard-wired dishwasher.

The 2020 NEC relocated the **GFCI dishwasher** requirement to 422.5(A)(7) **"Appliances",** but nothing has changed, GFCI protection is still required. See states: Appliances identified in Article 422.5(A)(1) through (7) rated 150 volts or less to ground and 60 amperes or less, single-or 3-phase, shall be provided with Class A GFCI protection.

NOTE:
Class A GFCI is rated at 5 mA; Class B GFCI is rated at 20 mA; Class C GFCI is rated at 20 mA and is intended to be used on **three-phase systems** where line-to-line voltage is 480 V or less. Class D GFCIs are intended to be used on 600 V systems.

210.8(D) Specific Appliances (Vending Machines)
Revised: Where the appliance is a **vending machine** as specified in 422.5(A)(5) and GFCI protection is not provided in accordance with 422.5(B)(3) or (B) (4), branch circuits supplying vending machines shall have GFCI protection in accordance with 422.5(B)(1) or (B)(2).

Comment: GFCI can be provided FIVE ways to vending machines.
(1) In the OCPD.
(2) Within a Receptacle.
(3) integral part of the attachment plug.
(4) within the supply cord and not more than 12-inches from the attachment plug.
(5) And Factory installed within the appliance.

210.8(E) and 210.63 Equipment Requiring Servicing
New: GFCI protection shall be provided for the receptacles required by 210.63.

Comment: The 2017 NEC required a 125-volt, single-phase, 15- or 20-ampere-rated receptacle to be installed at an accessible location within 25-feet of heating, air-conditioning, and refrigeration equipment. See 210.63. Nothing has changes here except the required receptacles shall be GFCI protected whether it is installed **"Indoors or Outdoors"** of equipment. The 2020 NEC, has expanded the GFCI requirement for receptacles that supports the servicing and repairing of equipment.

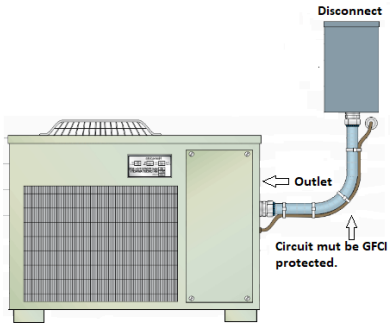
NOTE: The exception states; A receptacle outlet **SHALL NOT** be required at one and two-family dwellings for service of evaporative coolers. Also **dedicated space** must be provided per 110.26(E).


HVAC Air Handler Indoors


HVAC Air Handler Outdoors

210.8(F) Outdoor Outlets
New: All outdoor outlets for dwellings, other than those covered in 210.8(A) (3), Exception to (3), that are supplied by single-phase branch circuits rated 150 volts to ground or less, 50 amperes or less, shall have ground-fault circuit-interrupter protection for personnel.

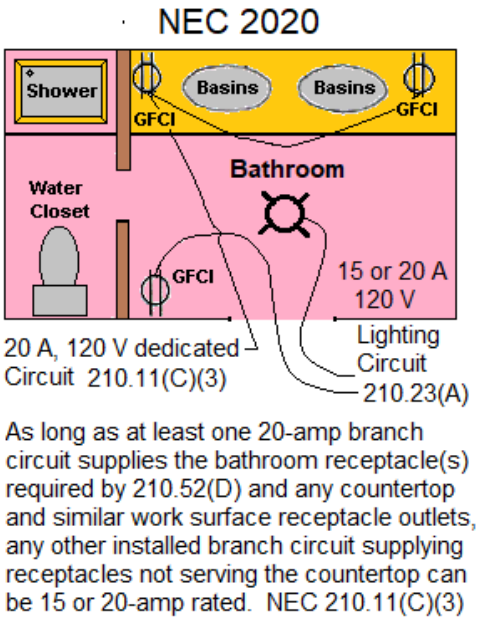
Exception: Ground-fault circuit-interrupter protection shall not be required on lighting outlets other than those covered in 210.8(C).



Comment: A new section, 210.8(F) has been added to require GFCI protection for all outdoor **outlets** supplied by single-phase branch circuits operating at 150-volts to ground or less and 50 amps or less. This is a significant change.

Public Input: This change is driven by some very major but unfortunate events. A public comment was submitted that outlined a tragic event in Chicago where a child was killed by coming in contact with an AC condenser unit outside that had a ground-fault to the frame.

Dwelling Rules: This change expands the outdoor protection to outlets (Hardwire), not just receptacle outlets. Receptacles are required to be GFCI protected when located outside per NEC 210.8(A)(3), and outlet are required to be GFCI protected when located outside and 50 amperes or less and 150 volts to ground per NEC 210.8(F). This requirement is focus on the "Heat Pumps" and "Air Conditioning Units". Now they will be required to be GFCI protected.



210.11(C)(3) Dwelling Units "Bathroom Branch Circuitss"
Revised: In addition to the number of branch circuits required by other parts of this section, ~~at least~~ one or more 120-volt, 20-ampere branch circuits shall be provided to supply the bathroom(s) receptacle outlet(s) required by 210.52(D) and any countertop and similar work surface receptacle outlets. 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 210.23(A)(1) and (A)(2).

Comment: Nowhere in 210.11(C)(3) did it state you can't put receptacle(s) in a bathroom that do not serve the countertop or similar work surfaces. In the 2017 NEC, the bathroom branch circuit was described as, "at least one 120-volt, 20-ampere branch circuit shall be provided to supply the bathroom(s) receptacles outlet(s). Such circuits shall have no other outlets." Some AHJ and installers were interpreting this rule incorrectly. They believed any receptacle installed in a dwelling unit bathroom has to be supplied by a 20-amperes dedicated 120-volt branch circuit. This was never the intend of the code.

For example, if you wanted to installed a 1000-volt-amp (watts), 120-volt, cord-and-plug connected electric heater in a bathroom, [1000 VA ÷ 120 V = 8.33 A x 125% = 10.4 A] you can do so with a 15-amp circuit. You're not required to run a 20-ampere, 120-volt circuit for the additional receptacle. But note that this circuit would have to meet the GFCI protected and Tamper-resistant requirements of the code.

The 2020 NEC made it clear that the 20-ampere, 120-volt branch circuit required by 210.52(D) is there to support the countertop and work surfaces receptacles. The question then: can a receptacle located in the bathroom NOT intended to serve a countertop or work surface be supplied by the 20-ampere dedicated bathroom circuit? **YES**. Are these additional receptacles required to be supplied by the 20-ampere dedicated branch- circuit? **NO**

210.11(C)(4) Garage Branch Circuits
Revised: In addition to the number of branch circuits required by other parts of this section, at least one 120-volt, 20-ampere branch circuit shall be installed to supply receptacle outlet(s) required by 210.52(G)(1) for attached garages and in detached garages with electric power. This circuit shall have no other outlets.

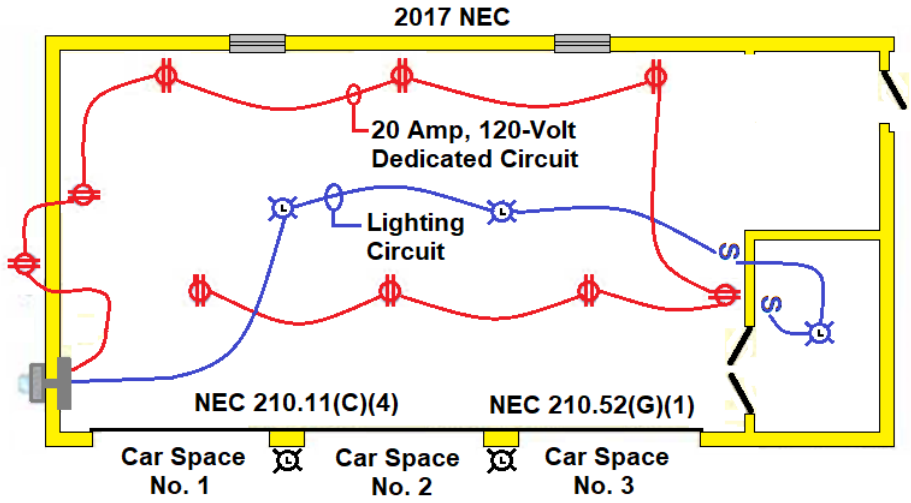
Exception: This circuit shall be permitted to supply readily accessible outdoor receptacle outlets.

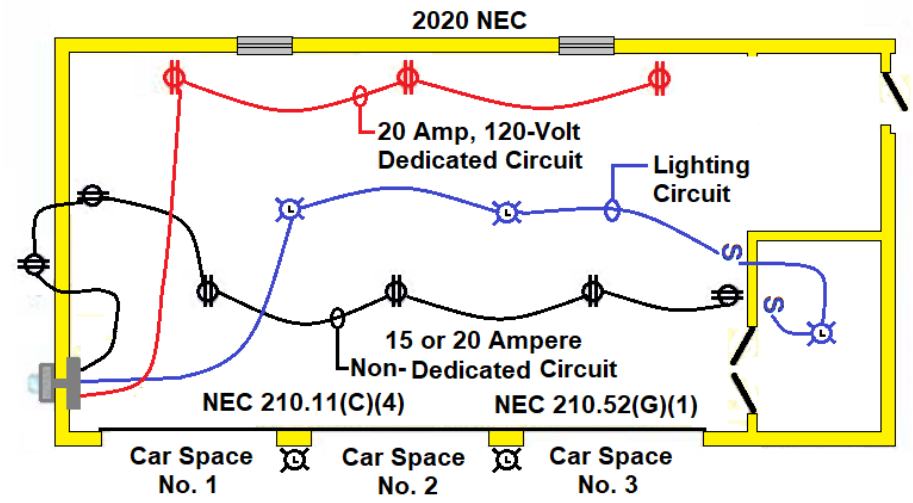
Comment: The 2017 NEC stated that at least one 20-ampere; 120-volt branch circuit shall be installed to supply receptacle outlets in attached and in detached garages with electric power. It was intended for **ALL 120**-volt receptacles installed in the dwelling unit garages to be supplied by a 20-ampere branch circuit. This circuit shall have no other outlets.

The 2020 NEC make it clear that the dedicated 120-volt, 20-ampere branch circuit shall have at least **one receptacle outlet installed for each vehicle bay** per NEC 210.52(G)(1). If you want additional receptacles installed in the garage, you can add them to the 20-ampere dedicated branch circuit, or run a 15 or 20-amperes circuit to support the additional receptacles outlets.

NOTE 1: Lighting outs are **NOT** allowed on the garage dedicated 20-ampere receptacle circuit. Reason being, it an outlet as defines in Article 100 and Article 210.11(C)(4) states: "This circuit shall have no other outlet." An outlet is not the same as a receptacle outlet. See Article 100 for definition of Outlet.

NOTE 2: Can another 15 or 20 ampere circuit be run to the garage for additional receptacles, also be used for the lighting outlets. I don't know of anywhere in the code that said you can't put lighting outlets on the additional circuit, but all receptacles located in the garage must be GFCI protected and you would not want to put the lights on a GFCI circuit.





210.12(C) Arc-Fault Circuit-Interrupter Protection "Guest Rooms, Guest Suites, and Patient Sleeping Rooms in Nursing Homes and Limited-Care Facilities"

Revised: All 120-volt, single-phase, 15-and 20-ampere branch circuits supplying **outlet**s and devices installed in guest rooms and guest suites of hotels and motels and patient sleeping rooms in nursing homes and limited-care facilities shall be protected by any of the means described in 210.12(A)(1) through (6).

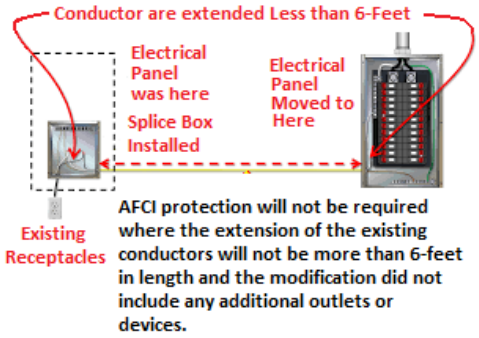
Comment: During the 2017 NEC, AFCI was expanded to include **guest rooms** and **guest suites of hotels and motels** as these areas are similar to dwelling units.

In the 2020 NEC, it has expanded to include AFCI protection for **patient sleeping rooms in Nursing Homes and Limited-Care Facilities.**

210.12(D) Arc-Fault Circuit-Interrupter Protection "Branch Circuit Extensions or Modifications - Dwelling Units, Dormitory Units, and Guest Rooms and Guest Suites"

Revised: Where branch circuit wiring for any of the areas specified in 210.12(A) or, (B), or (C) is modified, replaced, or extended, the branch circuit shall be protected by one of the following:

(1) By any of the means described in 210.12(A)(1) through (A)(6)
(2) A listed outlet branch-circuit-type AFCI located at the first receptacle outlet of the existing branch circuit.



Exception: AFCI protection shall not be required where the extension of the existing branch circuit conductors is not more than 1.8 m (6 ft) and does not include any additional outlets or devices, other than splicing devices. This measurement shall not include the conductors inside an enclosure, cabinet, or junction box.

Comment: The 2017 NEC address the requirements for AFCI for Dwelling Units and Dormitory Units. It also allowed the extension of the existing branch circuit conductors not more than 6-feet and does not include any additional outlets or devices, other than splicing devices. But it did not address how to measure the 6-foot.

The 2020 NEC has added **guest rooms and guest suites of hotels and motels** to the listed of required AFCI protection. It also provides a method of measuring the 6-foot when modifying or extending and existing circuits. The code now allows the measurement to be taken without including the conductors inside enclosure, cabinet, or junction box. **NCDOI has extended the additional length from 6-feet to 50-feet in the exception. .**

210.15 Reconditioned Equipment

New: The following shall not be reconditioned

(1) Equipment that provides Ground-Fault circuit-interrupter protection for personnel.
(2) Equipment that provides Arc-fault circuit-interrupter protection for personnel.
(3) Equipment that provides ground-fault protection for equipment.

Comment: This new section was added to prohibit the reconditioning of GFCI devices, AFCI devices, and ground-fault protection equipment. This is the first of these new statements throughout the code in reference to reconditioned equipment. Also see 210.21(A)(2)

Listed Below, the Reconditioned Equipment Permission Statements for the 2020 NEC

Code Section	CMP	Equipment	Yes/	SR/PC
210.15	CMP-2	GFCI devices, AFCI devices, and GFP equipment	**No**	SR 7657
240.62	CMP-10	Low-voltage fuse holders and low-voltage nonrenewable fuses	**No**	SR 7974, PC 981
240.88(A)(1)	CMP-10	Molded-case circuit breakers	**No**	DSR 8011, PC 980
240.88(A)(2)	CMP-10	Low- and medium-voltage power circuit breakers	Yes	DSR 8011, PC 980
240.88(A)(3)	CMP-10	High-voltage circuit breakers	Yes	DSR 8011, PC 980
240.88(B)(1)	CMP-10	Low-voltage power circuit breaker electronic trip units	**No**	DSR 8011, PC 980

240.88(B)(2)	CMP-10	Electromechanical protective relays and current transformers	Yes	DSR 8011, PC 980
240.102	CMP-10	Medium-voltage fuse holders and medium-voltage nonrenewable fuses	**No**	SR 8048, PC 982
406.3(A)	CMP-18	Receptacles	**No**	SR8187
406.7	CMP-18	Attachment plugs, cord connectors, and flanged surface devices	**No**	SR 8189
408.8(A)	CMP-9	Panelboards	**No**	SR8172, PC 987
408.8(B)	CMP-9	Switchboards and switchgear, or sections of switchboards or switchgear	Yes	SR 8172, PC 987
410.7	CMP-18	Luminaires, lampholders, and retrofit kits	**No**	SR 8162
411.4	CMP-18	Listed low-voltage lighting systems or a lighting system assembled from listed parts	**No**	SR 8164
490.49	CMP-9	Switchgear, or sections of switchgear	Yes	SR8222
695.10	CMP-13	Fire pump controllers and transfer switches	**No**	SR 7522, PC 983
700.5(C)	CMP-13	Automatic transfer switches (Emergency Systems)	**No**	SR7584, PC 984
701.5(C)	CMP-13	Automatic transfer switches (Legally Required Standby Systems)	**No**	SR 7586, PC 985
702.5	CMP-13	Transfer switches (Optional Standby Systems)	**No**	SR 7588, PC 986
708.24	CMP-13	Transfer equipment (Critical Operations Power Systems)	**No**	Sr7517
800.3(G)	CMP-16	Communication equipment [*must comply with 110.21(A)(2)]	Yes*	SR 7509

210.19(A)(1) General-Circuit Ratings
Revised: Branch-circuit conductors shall have an ampacity not less than the larger of 210.19(A)(1)(a) or <u>(A)(1)(b) and comply with 110.14(C) for equipment terminations</u>.

(a) Where a branch circuit supplies continuous loads or any combination or continuous and noncontinuous loads, the minimum branch-circuit conductor size shall have an ampacity not less than the noncontinuous loads plus 125 percent of the continuous load in accordance with 310.14.

(b) The minimum branch-circuit conductor size shall have an ampacity not less than the maximum load to be served after the application of any adjustment or correction factors in accordance with 310.15.

Exception No. 1 to (1)(a): If the assembly, including the overcurrent devices protecting the branch circuit(s), is listed for operation at 100 percent of its rating, the ampacity of the branch-circuit conductors shall be permitted to be less than the sum of the continuous load plus the noncontinuous load in accordance with 110.14(C).

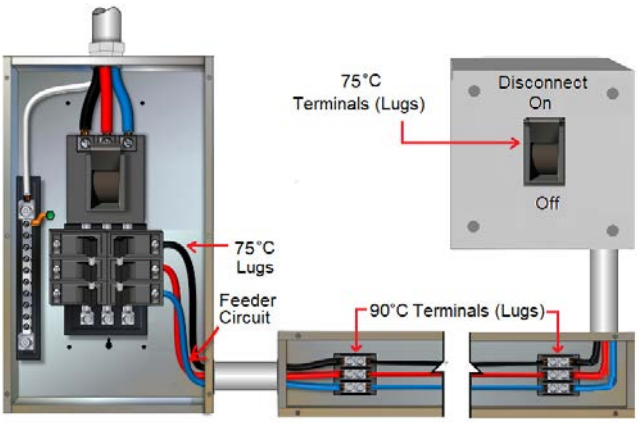
Comment: In accordance with the second sentence of 210.19(A)(1), conductors shall be sized to carry not less than the larger of 210.19(A)(1)(a) or (b). These sections, (a) and (b), contain two calculation procedures that are to be performed separately. The larger of the two sizes calculated is therefore the minimum size conductor required. Also, there are similar changes for sizing feeder conductors [215.2(A)(1)] and service conductors [230.42(A)].

Example: What size THHN (90°C) copper conductors are required to supply a branch circuit under the following conditions? The load is rated 40 amperes and considered continuous duty. There are nine current-carrying conductors and an equipment grounding conductor in this raceway. All terminations are rated 75°C and the maximum ambient temperature is 102°F).

Calculation No. 1
Step 1: NEC 210.19(A)(1)(a) Continues Duty
40 × 125% = 50.0 = 50 Amperes
Answer: 50 Amperes will need to be No. 8 AWG THHN (90°C), 50 Amperes, based on 75°C terminal per 110.14(C)(1).

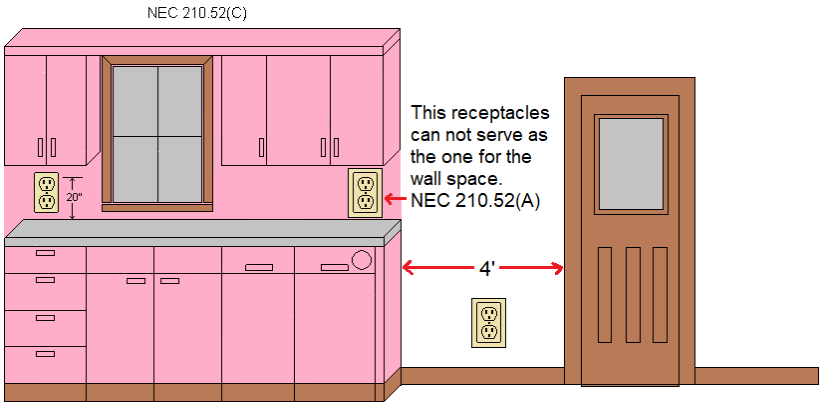
Calculation No. 2 Correction (Ambient) and Adjustment factor (Conduit Fill)
Step 2: NEC 210.19(A)(1)(b)
40A ÷ 91% (Table 310.15(B) = 43.9A Ambient Temp. ÷ 70% (Table 310.15(C)(1) = 62.7A Conduit Fill
Answer: 62.7 Ampere will need to be No. 6 THHN (90°C), based on the 75°C terminal per NEC 110.14(C)(1)..

210.19(A)(1) Exception No. 2 General-Circuit Ratings
NEW: Exception No. 2 to 1(a) and (1)(b): Where a portion of a branch circuit is connected at both its supply and load ends to separately installed pressure connections as covered in 110.14(C)(2), it shall be permitted to have an allowable ampacity, in accordance with 310.15, not less than the sum of the continuous load plus the noncontinuous load. No portion of a branch circuit installed under this exception shall extend into an enclosure containing either the branch-circuit supply or the branch-circuit load terminations.



Comment: This new exception address portion of a branch circuit that is connected at both ends; "supply end and load ends. This is allowed as long as the terminals (pressure connectors) are of the same rating for each end, (75°C to a 75°C or a 90°C to a 90°C). If one has a temperature rating less than the other, the lower will be used. CMP-2 recognizes the fact that the middle run of a conductor can be size smaller as long as the conductors can carry the load. Also, that portion of the conductors installed under this exception shall not extend into an enclosure containing either the branch-circuits supply or the branch-circuit load.

210.52(C) Dwelling Unit Receptacle Outlets "Countertops and Work Surfaces"
Revised: In kitchens, pantries, breakfast rooms, dining rooms, and similar areas of dwelling units, receptacle outlets for countertop and work surfaces that are 300 mm (12 in.) or wider shall be installed in accordance with 210.52(C)(1) through (G)(5) (C)(3) and shall not be considered as the receptacle outlets required by 210.52(A).



For the purposes of this section, where using multioutlet assemblies, each 300 mm (12 in.) of multioutlet assembly containing two or more receptacles installed in individual or continuous lengths shall be considered to be one receptacle outlet.

Comment: When a receptacle outlet is installed above the countertop in a kitchen near the edge of the countertop, but close to the wall space of the nook or living room area. Can this one receptacle outlet satisfy the countertop or work surface receptacle outlets requirement of 210.52(C) and at the same time satisfy the wall spacing requirements of 210.52(A)? The 2020 NEC, CMP-2 said **NO** to this question. The receptacles outlets installed per 210.52(A) to serve the countertops and work surfaces in kitchens, pantries, breakfast rooms, dining rooms, and similar areas **cannot** be considered as the receptacle outlets required by 210.52(A).

210.52(C)(2) Dwelling Unit Receptacle Outlets "Island and Peninsular Countertops and Work Surfaces"
New: Receptacle outlets shall be installed in accordance with 210.52(C)(2)(a) and (C)(2)(b).

(a) At least one receptacle shall be provided for the first 0.84 m^2 (9 ft^2), or fraction thereof, of the countertop or work surface. A receptacle outlet shall be provided for **every additional 1.7 m^2 (18 ft^2),** or fraction thereof, of the countertop or work surface.

(b) At least one receptacle outlet shall be located within 600 mm (2 ft) of the outer end of a peninsular countertop or work surface. Additional required receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner. The location of the receptacle outlets shall be in accordance with 210.52(C)(3). A peninsular countertop shall be measured from the connected perpendicular wall.

Comment: Island and Peninsular Countertops and Work Surfaces
The method for determining the minimum number of 125-volt, 20-ampere receptacle outlets required to serve a dwelling unit island or peninsular countertop/work surface has been revised. In previous editions of the *Code*, one would simply take a measurement across the countertop to determine if the rule of one required receptacle was required. If the measurement consisted of a long dimension of 24 inches or greater and a short dimension of 12 inches or greater, one receptacle was required to serve the island or peninsula. This one receptacle was Code compliant regardless of the size of the countertop or work surface.

For the 2020 NEC, at least one receptacle outlet would be required for the first 9-square feet, or fraction thereof, of the countertop or work surface (Island and Peninsular). An additional receptacle outlet(s) would then be required for every additional 18-square feet, or fraction thereof, of the countertop or work surface.

210.52(C)(2) Island and Peninsulas

Examples of Minimum Number of Receptacle Outlets Required

Total Square Footage of Countertop	Minimum No. of Receptacle Outlets
8 sq. ft.	1
9 sq. ft.	1
More than 9 sq. ft. up to 27 sq. ft. [9 sq. ft. + 18 sq. ft. = 27 sq. ft.]	2
28 sq. ft. [first 9 sq. ft. (one), additional 18 sq. ft. (one) and addition fraction there of (1 sq. ft.) (one)]	3
48 sq. ft. [48 sq. ft. - 9 sq. ft. = 39 sq. ft.] [39 sq. ft. ÷ 18 sq. ft. = 2.17 sq. ft.]	4

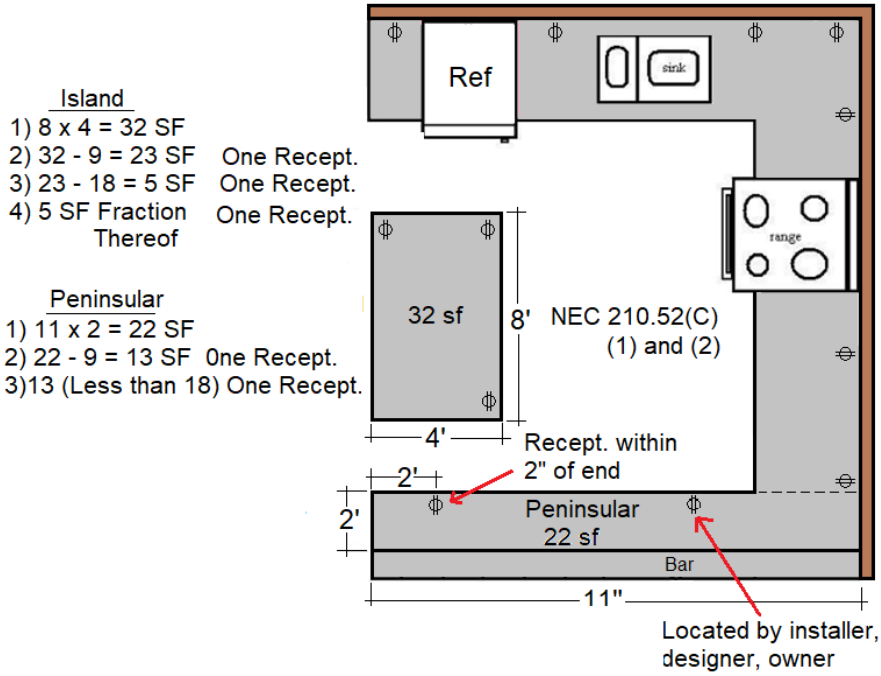
210.52(C)(2)(a) Island and Peninsular Countertops and Work Surfaces

At least one receptacle outlet shall be provided for the first 0.84 m^2 (9 ft^2), or fraction thereof, of the countertop or work surface.

A receptacle outlet shall be provided for every additional 1.7 m^2 (18 ft^2), or fraction thereof, of the countertop or work surface.

Example: Kitchen Island is 50 Sq Ft. How many GFCI Receptacles are required?

Example Calculating Square Footage of Countertop to determine Receptacles required	Minimum Number of Receptacle Outlets
Work Surface is 50 Sq Ft in size.	**Receptacles Count**
50 Sq Ft – 9 Sq Ft = 41 Sq Ft	1
41 Sq Ft – 18 Sq Ft = 23 Sq Ft	1
23 Sq Ft – 18 Sq Ft = 5 Sq Ft	1
5 Sq Remain	1
Total Outlets Required	**4**



210.52(E)(3) Dwelling Unit Receptacle Outlets "Outdoor Outlet, Balconies, Decks and Porches"
Revised: Balconies, decks, and porches that are within 102 mm (4 in.) horizontally of the dwelling unit shall have at least one receptacle outlet accessible from the balcony, deck, or porch. The receptacle outlet shall not be located more than 2.0 m (6 ½ ft) above the balcony, deck, or porch walking surface.

Comment: This requirement applies only to porches, balconies, `or decks that are attached to dwelling units or within 4-inches horizontally of a dwelling units. Don't forget maximum 6 1/5 ft above walking surface.

If a porches, balconies, or decks **ARE** detached from a dwelling unit per NEC 210.52(E)(3), receptacle outlets are not required, even if electric power is provided.

210.52(G)(1) Exception: Dwelling Unit Receptacle Outlets "Basement, Garages, and Accessory Building"
Revised: Garages in each attached garage and in each detached garage with electric power, at least one receptacle outlet shall be installed in each vehicle bay and not more than 1.7 m (5 ½ ft) above the floor.

NEC 210.52(G)(1) Ex. Detached Garage for Multifamily Dwellings

Exception: Garage spaces not attached to an individual dwelling unit of a multifamily dwelling shall not require a receptacle outlet in each vehicle bay.

Comment: Detached garages at multifamily dwelling complex **DO NOT** have to have a receptacle installed for each car space, even if electric power is provided for lighting. Also see NEC 210.11(C)(4).

210.63(B) Other Electrical Equipment
Revised: In other than one- and two- family dwellings, a receptacle outlet shall be located as specified in 210.63(A)(1) and (B)(2)

(A)(1) Indoor Service Equipment. The required receptacle outlet shall be located within the same room or area as the service equipment.

(A)(2) Indoor Equipment Requiring Dedicated Equipment Spaces. Where equipment, other than service equipment, requires dedicated equipment spaces as specified in 110.26(E), the required receptacle outlet shall be located within the same room or area as the electrical equipment and shall not be connected to the load side of the equipment's branch-circuit disconnecting means.

Comment: There are two new subsections added to these sections. They are required to support portable test and diagnostic equipment that requires a 120-volt power source. The receptacle is **NOT PERMITTED** to be on the load side of the equipment's branch-circuit disconnecting means, the reason is so that the receptacle can be used while the disconnecting means is open. The receptacle is **NOT REQUIRED** in one – or two –family dwellings.

210.65 Meeting Rooms
Relocated and Revised: Each meeting room of not more than 93 m^2 (1000 ft^2) in other than dwelling units shall have outlets for nonlocking-type, 125 volt, 15- or 20-ampere receptacles. The outlets shall be installed in accordance with 210.65(B). Where a room or space is provided with movable partition(s), each room size shall be determined with the partition in the position that results in the smallest size meeting room.

Informational Note No. 1: For the purposes of this section, meeting rooms are typically designed or intended for the gathering of seated occupants for such purposes as conferences, deliberations, or similar purposes, where portable electronic equipment such as computers, projectors, or similar equipment is likely to be used.

Informational Note No. 2: Examples of rooms that are not meeting rooms include auditoriums, schoolrooms, and coffee shops.

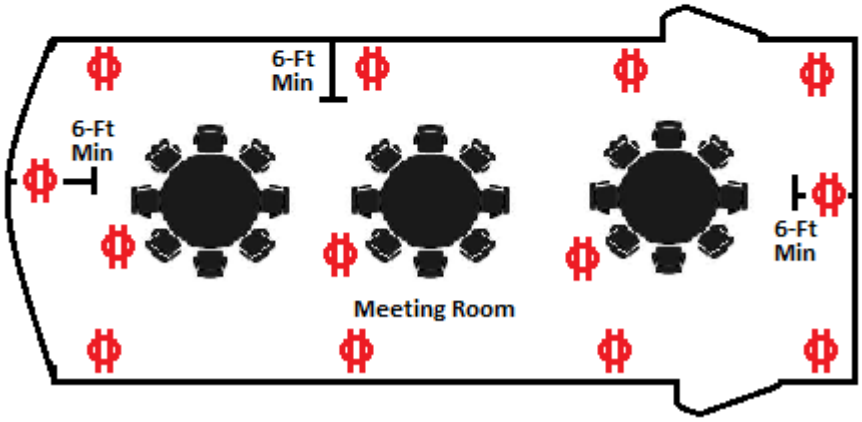
(B) Receptacle Outlets Required. The total number of receptacle outlets, including floor outlets and receptacle outlets in fixed furniture, shall not be less than as determined in (1) and (2

(1) Receptacle Outlets in Fixed Walls. The required number of receptacle outlets to be installed is determined in accordance with 210.52(A) through (A)(4). These receptacle outlets shall be permitted to be located as determined by the installer, designer, or building owner.

(2).Floor Outlets. A meeting room with any floor dimension that is 3.7 m (12 ft) or greater in any direction and that has a floor area of at least 20 m^2 (215 ft^2) shall have at least one floor receptacle outlet located in the floor, or at least

one floor outlets to serve receptacle(s), located at a distance not less than 1.8 m (6 ft) from any fixed wall for each 20 m^2 (215 ft^2) or major portion of floor space.

Comment: This section was moved from NEC 210.71 to NEC 210.65. It now makes it clear that non-rectangular meeting rooms such as round-shaped meeting rooms also apply to meeting room.



Example: Room Size 800 SF Meeting Room – 215 SF (One Receptacle) = 585 SF – 215 SF (One Receptacle) =370 SF - 215 SF (One Receptacle) =60 Sf (A receptacles is not required because 60 SF is not a major portion of floor space.) So, three (3) receptacles are required for the floor area.

210.70(A)(1) Lighting Outlets Required: "Habitable Rooms"
Revised: At least one lighting outlet controlled by a listed wall-mounted control device shall be installed in every habitable room, kitchen, and bathroom. The wall-mounted control device shall be located near an entrance to the room on a wall.

Exception No. 1: In other than kitchen and bathrooms, one or more receptacles controlled by a listed wall mounted control device shall be permitted in lieu of lighting outlets.

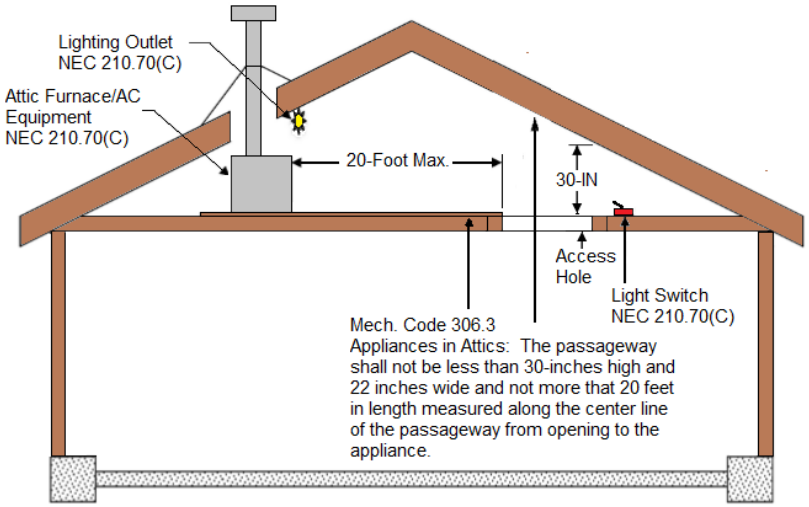
Exception No. 2: Lighting outlets shall be permitted to be controlled by occupancy sensors that are (1) in addition to listed wall mounted control devices or (2) located at a customary wall switch location and equipped with an override that will allow the sensor to function as a wall switch.

Comment: In a nut shell, this section requires a wall-mounted switch to be installed whether or not the lighting outlet has a remote-control device. The revision makes it clear that remote wireless devices that can communicate with a controller that controls lighting outlet or receptacle are allowed, but a wall mounted control device will still have to be installed and has to be installed on a wall located near the entrance to the room. Example of some of the new technology is smartphone, Google Home, and Alexa.

210.70(C) Lighting Outlets Required: "All Occupancies"

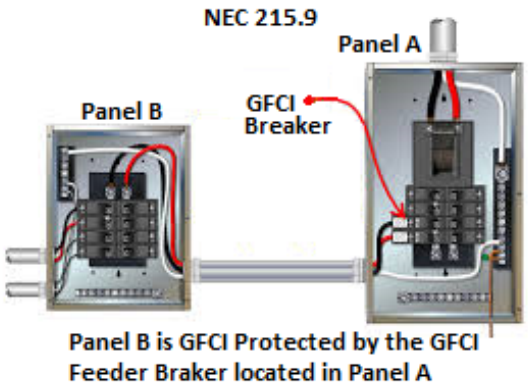
Revised: For attics and underfloor spaces, utility room, and basements, at least one lighting outlet containing a switch or controlled by a wall switch or listed wall-mounted control device shall be installed where these spaces are used for storage or contain equipment requiring servicing. A point of control shall be at each entry that permits access to the attic and underfloor space, utility room, or basement. Where a lighting outlet is installed for equipment requiring service, the lighting outlet shall be installed at or near the equipment.

Comment: A point of control is required at each point of entry to attic, underfloor spaces, utility rooms, and basements, when these spaces are used for **storage or contain equipment**. Also see 320.23(A) Accessible Attics "Cable Run Across the Top of Floor Joists".



215.9 GFCI Protection with Feeders

Revised: Feeders ~~supplying 15 – and 20-ampcrc~~ ~~r~~eceptacle ~~branch circuits~~ shall be permitted to be protected by a ground-fault circuit interrupter installed in a readily accessible location in lieu of the provisions for such interrupters as specified in 210.8 and 590.6(A).



Comment: These revisions will now allow the feeders to be protected by a GFCI protection in lieu of GFCI protection as specified in 210.8 and 590.6(A) for branch circuits.

2017 Requirement: Ground-fault circuit interrupter (GFCI) protection at the feeder was limited to feeders supplying **15- and 20-ampere receptacle branch circuits,** and the feeder GFCI device was installed in a readily accessible location.

In other words, it was permissible for the feeder level GFCI protection to protect branch circuits in lieu of the branch circuit level GFCI protection specified in 210.8 (A) through (F) for GFCI for personnel and 590.6(A), GFCI for temporary wiring.

2020 Requirement: The GFCI protected feeders is **now permitted** to protected **any branch circuit,** specified in 210.8(A) and (B). Without this change the feeder GFCI protection would not had been allowed. This change applies to receptacles and hard-wired circuits.

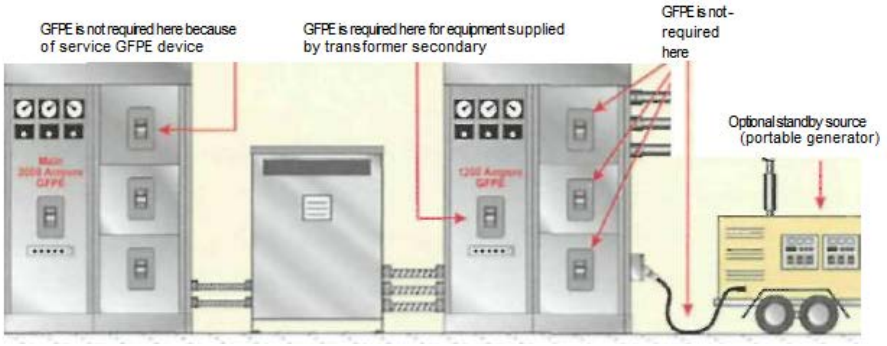
215.10 Exception No. 3 GFCI Protection of Equipment
Each feeder disconnect rated 100 amperes or more and installed on a solidly grounded wye electrical system of more than 150 volts to ground, but not exceeding 600 volts phase-to phase, shall be provided with ground-fault protection of equipment in accordance with 230.95.

Exception One: This section shall not apply to a disconnecting means for a continuous industrial process where a non-orderly shutdown will introduce additional or increased hazards. And

Exception Two: This section shall not apply if ground-fault protection of equipment is provided on the supply side of the feeder and on the load side of any transformer supplying the feeder.

New: Exception No. 3: If temporary feeder conductors are used to connect a generator to a facility for repair, maintenance, or emergencies, ground-fault protection of equipment shall not be required. Temporary feeders without ground-fault protection shall be permitted for the time period necessary but shall not exceed 90 days.

Comment: Per exception No. 1, Ground-Fault Protection of Equipment is **not required** if the shutdown will add increased hazards, and for exception No. 2., Ground-Fault Protection of Equipment is **not needed** if it is already provided ahead of the feeder. The new exception No. 3 was added to permit temporary feeders to be used during repair, maintenance or emergencies without Ground-Fault Protection of Equipment, but not to exceed 90 days.



220.12(A) Lighting Load for Non-Dwelling Occupancies
New: A unit load of not less than that specified in Table 220.12 for non-dwelling occupancies and the floor area determined in 220.11 shall be used to calculate the minimum lighting load. Motors rated less than 1/8 HP and connected to a lighting circuit shall be considered general lighting load.

Informational Note: The unit values of Table 220.12 are based on minimum load conditions and 100 percent power factor and may not provide sufficient capacity for the installation contemplated.

Comment: Section 220.12 and Table 220.12 has been completely revised. It now applies to Non-Dwelling Occupancy, and has reduced the lighting loads in most occupancy. Dwelling units has been moved to 220.14(J). In 2017 NEC, Table 220.12 addressed 17 specific occupancies, dwelling and non-dwelling units. The 2020 NEC, Table 220.12 has 29 occupancies, focusing on non-dwelling units. See note below. Table 220.12 has the 125% multiplier included in the unit load values.

Table 220.12 General Lighting Loads by Non-Dwelling Occupancy

	Unit Load (The Cross Out Numbers are the old VA/ft²)	
Type of Occupancy	**Volt-amperes/m^2**	**Volt-amperes/ ft^2**
Automotive facility	16	1.5
Convention Center	15	1.4
Courthouse *(was Courtrooms)*	15 ~~22~~	1.4 ~~2.0~~
Dormitory	16	1.5
Exercise center	15	1.4
Fire station	14	1.3
Gymnasium[1] *(was Armories and auditoriums)*	18 ~~11~~	1.7 ~~1.0~~
Health care clinic *(was Hospitals)*	17 ~~22~~	1.6 ~~2.0~~
Hospital	17	1.6
Hotels and motels, including apartment houses without provisions for cooking by tenants [b]	18 ~~22~~	1.7 ~~2.0~~
Library	16	1.5
Manufacturing facility [c] *[was Industrial commercial (loft)*	24 ~~22~~	2.2 ~~2.0~~
Motion picture theater	17	1.6
Museum	17	1.6
Office [d] *(was Office buildings)*	14 ~~39~~	1.3 ~~3.5~~
Parking garage [e] *[was Garages-commercial (storage)]*	3 ~~6~~	0.3 ~~0.5~~
Penitentiary	13	1.2
Performing arts theater	16	1.5
Police station	14	1.3
Post office	17	1.6
Religious facility *(was Churches)*	24 ~~11~~	2.2 ~~1.0~~
Restaurant [f] *(was Restaurants and Clubs)*	16 ~~22~~	1.5 ~~2.0~~
Retail [g, h] *(was Barber shops and beauty parlors and*	20 ~~33~~	1.9 ~~3.0~~
School/university *(was Schools)*	33	3.0
Sports arena	33	3.0
Town hall	15	1.4
Transportation	13	1.2
Warehouse	13 ~~3~~	1.20 ~~0.25~~
Workshop	18	1.7

Note: The 125 percent multiplier for a continuous load as specified in 210.20(A) is included when using the unit loads in this table for calculating the minimum lighting load for a specified occupancy.

[a.] Armories and auditoriums are considered gymnasium-type occupancies.

[b.] Lodge rooms are similar to hotels and motels.

[c.] Industrial commercial loft buildings are considered manufacturing-type occupancies.

[d.] Banks are office-type occupancies.

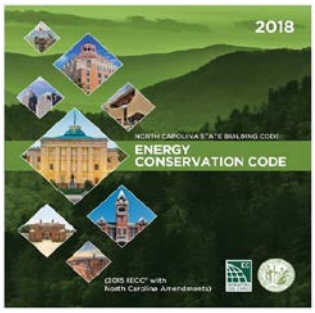
[e.] Garages — commercial (storage) are considered parking garage occupancies.

[f.] Clubs are considered restaurant occupancies.

[g.] Barber shops and beauty parlors are considered retail occupancies.

[h.] Stores are considered retail occupancies

220.12(B) Lighting Load for Non-Dwelling Occupancies "Energy Code"



New: Where the building is designed and constructed to comply with an energy code adopted by the local authority, the lighting load shall be permitted to be calculated at using the unit values specified in the energy code where the following conditions are met:

(1) A power monitoring system is installed that will provide continuous information regarding the total general lighting load of the building.
(2) The power monitoring system will be set with alarm values to alert the building owner or manager if the lighting load exceeds the values set by the energy code. Automatic means to take action to reduce the connected load shall be permitted.
(3) The demand factors specified in 220.42 are not applied to the general lighting load.
(4) The continuous load multiplier of 125 percent shall be applied.

Comment: A revision was made to clarify that an automatic means shall be permitted to take action in reducing the connected load when the load exceeds the values set by the energy code. Also the continuous load multiplier of 125 percent shall be applied to continuous duty loads.

220.14(J) Dwelling Units

New/Revised: In one-family, two-family, and multifamily dwellings, the minimum unit load shall be not less than 33 VA volt-amperes/m^2 (3 VA volt-amperes/ft^2). The lighting and receptacle outlets specified in 220.14(J)(1), (J)(2), and (J)(3) are included in the minimum unit load. No additional load calculations shall be required for such outlets. The minimum lighting load shall be determined using the minimum unit load and the floor area as determined in 220.11 for dwelling occupancies. Motors rated less than1/8 hp and connected to a lighting circuit shall be considered part of the minimum lighting load.

(1) All general-use receptacle outlets of 20-ampere rating or less, including receptacles connected to the circuits in 210.11(C)(3) and 210.11(C)(4).
(2) The receptacle outlets specified in 210.52(E) and (G).
(3) The lighting outlets specified in 210.70.

Comment: The calculation of 3 volt amp per square foot for dwelling units was moved **from** Table 220.12 to 220.14(J). A new sentence was also added to address motors rated less than 1/8 HP and connected to a lighting circuit. These small motor loads will now be included in the general lighting load as these loads are minimum and can be safely be added to the unit load of 3 VA per square feet as demonstrated by a long history of using this method by many installers and designers.

Also **guest rooms or guest suites of hotels and motels** were removed and relocated to the new 220.14(M).

Calculation of general-purpose branch circuits is determined by using a unit a unit load of 3 volt-amperes per square foot for dwelling units. See 220.14(J)

For dwelling units, the calculated floor area shall not include open porches, garages, or unsued or unfinished spaces not adapatable for future use. See 220.11

220.42 Lighting and Demand Factors Table

Revised: The demand factors specified in Table 220.42 shall apply to that portion of the total branch-circuit load calculated for general illumination. They shall not be applied in determining the number of branch circuits for general illumination.

220.42
Lighting Load Demand Factors

Table 220.42 Lighting Load Demand Factors		
Type of Occupancy	**Portion of Lighting Load to Which Demand Factor Applies (Volt-Amperes)**	**Demand Factor (%)**
Dwelling Units	First 3000 at From 3001 to 120,000 at Remainder over 120,000 at	100 35 25
~~Hospitals~~	~~First 50, 000 at~~ ~~Remainder over 5O,0OO at~~	~~40~~ ~~20~~
Hotels and Motels, (including apartment houses without provisions for cooking by tenants*	First 20,000 at From 20,001 to 100,000 at Remainder over 100,000 at	60 ~~50~~ 50 ~~40~~ 35 ~~30~~
Warehouses (storage)	First 12,500 or less at Remainder over 12,500 at	100 50
All Others	Total volt-amperes	100
*The demand factors of this table shall not apply to the calculated load of feeders or services supplying areas in ~~hospitals~~, hotels and motels where the entire lighting is likely to be used at one time, as in ~~operating room~~, ballrooms or dining rooms.		

Comment: In 2017 NEC; Table 220.42 pertains to lighting load applicable to dwelling units, hospitals, hotels, motels, and warehouses. All other occupancies are required to be calculated at 100 percent of the total volt-amperes rating.

When determining the general illumination lighting loads for specific types of occupancies, the demand factors specified in Table 220.42 are required to be applied to that portion of the total branch-circuit load being calculated. These demand factors are a percentage of a portion of a specified lighting load to which these demand factors are to be applied. For example, Table 220.42 tells the user of the *Code* to calculate the lighting load of a warehouse at 100 percent for the first 12,500 (or less) volt amperes and the remainder that is over 12, 500 VA is calculated at 50 percent.

220.53 Appliance Load – Dwelling Unit

Revised: It shall be permissible to apply a demand factor of 75 percent to the nameplate rating load of four or more appliances <u>rated ¼ hp or greater, or 500 watts or greater, that are fastened in place, and</u> that are served by the same feeder or service in a one-family, two-family, or multifamily dwelling. <u>This demand factor shall not apply to:</u>

(1) Household electric cooking equipment that is fastened in place
(2) Clothes dryers
(3) Space heating equipment
(4) Air-conditioning equipment

Comment: In previous Code 220.53 permitted a demand factor of 75 percent to be applied to the nameplate rating load of four or more appliances fastened in place, other than electric ranges, clothes dryers, space-heating equipment or air-conditioning equipment, that are served by the same feeder or service. This demand factor assumes that **NOT ALL** the appliances are operating at the same time. Also the load on the appliance nameplate must be known before the demand factor of this section is permitted to be applied.

NOTE: This has been a part of the Code since the 1947 NEC edition.

220.60 Noncoincident Loads

Revised: Where is unlikely that two or more noncoincident loads will be in use simultaneously, it shall be permissible to use only the largest load(s) that will be used at one time for calculating the total load of a feeder or service. Where a motor is part of the noncoincident load and is not the largest of the noncoincident loads, 125 percent of the motor load shall be used in the calculation if it is the largest motor.

Comment: A new sentence was added to clarify that the 125 percent demand factor per 220.18(A) shall be used to determine motor load when the motor is one of the noncoincident loads.

Example: Central Heating Unit, 10,000 VA strip heat with 1,200 VA motor, 240 Volts, single phase, and AC unit, 1,600 VA, 240 Volts, single phase.

Step 1: 10,000 VA + (1,200 VA x 125%) 1500 VA = 11,500 VA

Sep 2: 1,600 VA x 125% = 1,875 VA

Answer: 11,500 VA

220.87 Determining Existing Loads

Revised/New: The calculation of a feeder or service load for existing installations shall be permitted to be use actual maximum demand to determine the existing load under all of the following conditions:

(1) The maximum demand data is available for a 1-year period.

Exception: If the maximum demand data for a 1-year period is not available, the calculated load shall be permitted to be based on the maximum demand (the highest average kilowatts reached and maintained for a 15-minute interval) continuously recorded over a minimum 30-day period using a recording ammeter or power meter connected to the highest loaded phase of the feeder or service, based on the initial loading at the start of the recording. The recording shall reflect the maximum demand of the feeder or service by being taken when the building or space is occupied and shall include by measurement or calculation the larger of the heating or cooling equipment load, and other loads that may be periodic in nature due to seasonal or similar conditions.

(2) The maximum demand at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

(3) The feeder has overcurrent protection in accordance with 240.4, and the service has overload protection in accordance with 230.90.

Exception: If the feeder or service has any renewable energy system (i.e., solar photovoltaic systems or wind electric system) or employs any form of peak load shaving, this calculation method shall not be used.

Comment: This new exception has been added to clarify that a feeder or service that includes any form of renewable energy or peak load shaving system that will effectively alter the actual peak demand load seen by the meter maximum demand data shall not be used for determining actual peak demand for the feeder or service.

NOTE: To date, there is no effective way to determine the contribution from these systems so the peak demand could be calculated.

225.22 Raceways on Exterior Surface of Buildings or Other Structures.
Review: raceways on exterior of buildings or other structures shall be arranged to drain and shall be listed or approved for use on wet locations.

Comment: A new section has been added to make it clear raceways installed on exteriors of buildings or other structures shall be arranged to drain and shall be listed or approved for use in wet locations. **Also see** 300.5(B) "Underground Installation, Wet Locations"; 300.5; 300.9 "Raceway in wet locations Abovegrade"; "Wet Locations 310.10(C)".

225.30(B) Common Supply Equipment (Feeders)
New: Where feeder conductors originate in the same panelboard, switchboard, or other distribution equipment, and each feeder terminates in a single disconnecting means, not more than six feeders shall be permitted. Where more than one feeder is installed in accordance with this section, all feeder disconnects supplying the building or structure shall be grouped in the same location, and the requirements of 225.33 shall not apply. Each disconnect shall be marked to indicate the load served.

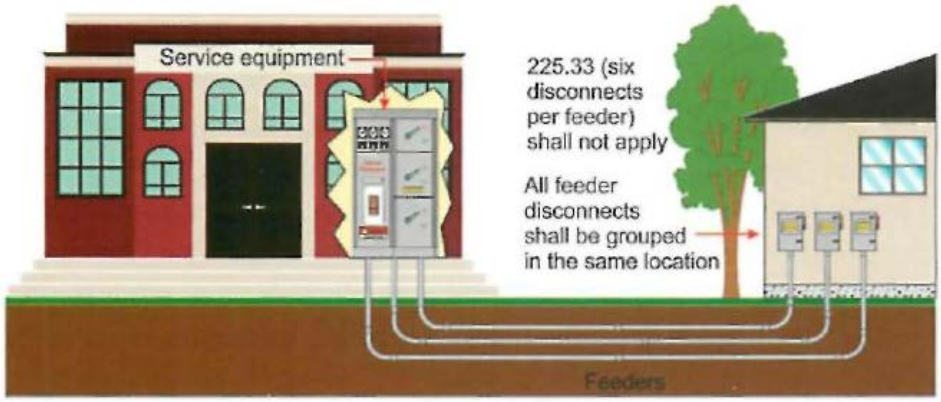
Comment: In the 2017 NEC, building or other structure that was served by an outside feeder could only be supplied by **one feeder** unless another feeder was permitted by the special conditions.

In the 2020 NEC, a building or other structure that is served by an outside feeder is still generally limited to one feeder unless permitted by special conditions. A new 225.30(B) was added providing more conditions that will allow more than **one feeder** to supply a building or other structure that is served by an outside feeder. This new text will permit up to six feeders to supply a building or structure under the following conditions:

(1) Each feeder must originate in the same panelboard, switchboard or other distribution equipment.
(2) Each feeder must terminate in a single disconnecting means. This prohibits the application of 225.33 which permits up to six disconnecting means from a single feeder.
(3) Where more than one feeder is installed in accordance with this section all feeder disconnects are required to be grouped in the same location.
(4) Each disconnect must be marked to indicate the load served.

Article 215 (Feeders) does not restrict the number of feeders that can be installed within a building. Feeders are very different than service conductors in that feeders have overcurrent protection. Service laterals and overhead service conductors are allowed up to six disconnecting means with six separate laterals or six separate overhead service masts. Under the 2017 NEC, outside feeders to separate buildings were not afforded that same provision. Feeders to separate buildings were only allowed one feeder to serve up to six disconnects.

Safety: From a safety standpoint a designer may want to exchange a large feeder for two or three smaller feeders. This could possibly reduce fault current, arc flash energy or reduce the size of the equipment at a building supplied by a feeder(s). This new requirement permits multiple feeders (each with a single disconnecting means) instead of a single large feeder with six disconnects. Given the fact that feeders have the added benefit of overcurrent and short circuit protection there is no logical or safety reason why a feeder should not be afforded the same requirements as service conductors.

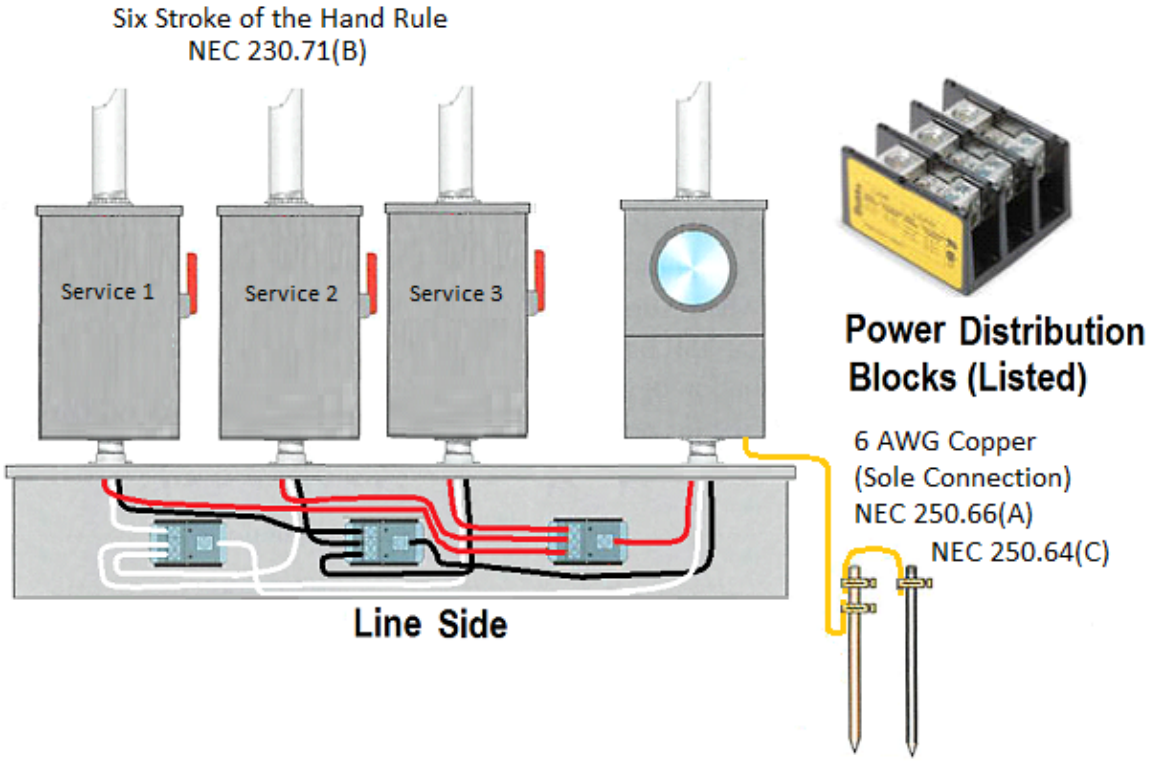


230.46 Splice and Tapped Conductors
Revised: Service-entrance conductors shall be permitted to be spliced or tapped in accordance with 110.14, 300.5(E), 300.13, and 300.15. Power distribution blocks, pressure connectors, and devices for splices and taps shall be listed. Power distribution blocks installed on service conductors shall be marked “suitable for use on the line side of the service equipment" or equivalent.

Effective January 1, 2023, pressure connectors and devices for splices and taps installed on service conductors shall be marked "suitable for use on the line side of the service equipment" or equivalent.

Comment: Requirement for power distribution blocks installed on service conductors required to be marked **"suitable for use on the line side of the service equipment"** or equivalent by January 1, 2023.

A power distribution block installed on the line side of service conductors is based on the application of a short circuit current rating without the benefit of an upstream overcurrent protective device. Power distribution blocks are intended to be permanently fixed within an enclosure (wire connectors are not) and may be used to terminate conductors of opposite polarity or phase (similar to a wire connector that is an integral part of a panelboard).

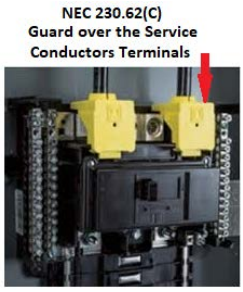


Information you may have forgotten:
NEC 250.24(B) Main Bonding Jumper at Service “**Unspliced**”
NEC 250.30(A)(1) System Bonding Jumper “**Unspliced**”
NEC 250.64(C) Grounding Electrode Conductor Installation “**May be Spliced**” if 250.64(C) is met.

Other Information you may have forgotten:
NEC 250.24(C) Grounded Conductor Brought to Service “Main Bonding Jumper at each Service Disconnecting Means
NEC 250.24(D) Grounding Electrode Conductor at Service “Grounding Electrode(s) Conductors Installed per NEC 250.50”
NEC 250.28 Main Bonding Jumper and System Bonding Jumper “Material, Attachment, Size”
NEC 52(A)(1) thru (8) Grounding Electrode
NEC 250.64(D)(1) Common Grounding Electrode Conductor and Taps
NEC 250.70 Method of Grounding and Bonding Conductor Connection to Electrodes

230.62 Service Equipment – Enclosed or Guarded.

Relocated/New: Barriers shall be placed in service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while serving load terminations.



Comment: This requirement was relocated from 408.3(A)(2) of the 2017 NEC to 230.62(C). Also the exception to 408.3(A)(2) "not requiring a barrier for more than one service disconnect within a single enclosure" was deleted.

Barriers are now required to be placed in **all types** of service equipment such that no uninsulated, ungrounded service busbar or service terminal is exposed to inadvertent contact by persons or maintenance equipment while servicing load terminations.

230.67(A) Surge Protection

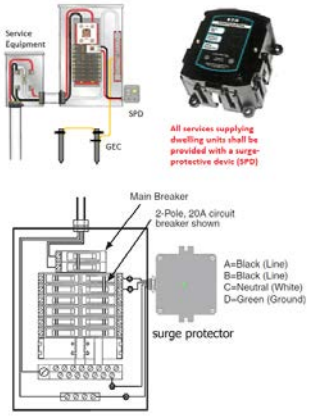
Revised: Device. All services supplying dwelling units shall be provided with a surge-protective device (SPD).

(B) Location: The SPD shall be an integral part of the service equipment or shall be located immediately adjacent thereto.

Exception: The SPD shall not be required to be located in the service equipment as required in (B) if located at each next level distribution equipment downstream toward the load.

(C) Type. The SPD shall be a Type 1 or Type 2 SPD.

(D) Replacement. Where service equipment is replaced, all of the requirements of this section shall apply.



Comment: All dwelling unit services **are now required** to be provided with surge-protection. The surge protection device (SPD) must be an integral part of the service equipment or located immediately adjacent to the service equipment unless it is supplied at each next level distribution equipment downstream toward the load. This SPD is required to be either a Type 1 or Type 2 SPD. This requirement applies to residential service equipment being replaced as well.

This new SPD requirement aligns with the need for surge protection to protect sensitive electronics systems found in most appliances and equipment used in today s modern dwelling units. Additionally, the expanding use of roof top solar photovoltaic units, wind generating units, battery storage systems, etc, can also result in more opportunity for the introduction of surges into the system.

What are SPDs?

These devices have been installed in commercial services for some time and have been referred to as TVSS's or Transient Voltage Surge Suppressors. The 2009 edition of UL 1449 changed the name from TVSS to SPD or Surge Protection Devices. These devices limit voltage spikes or surges on the electrical system which are caused by lightning strikes, or from large inductive loads, such as motors, being turned on an off. When magnetic fields are generated, they expand and collapse when a motor is turned on and off. It is this expanding and collapsing magnetic field that creates voltage spikes. SPDs are basically filters that protect the electrical equipment and people from these sudden voltage spikes.

What is the difference between Type 1 and Type 2 SPDs?

A Type 1 SPD is a hardwired, permanently connected SPD which may be **installed on the utility side of the main service** overcurrent protective device (i.e. before the main breaker at the service), or it may be installed after the main breaker. The Type 1 SPD can be installed on the line side or load side of the main breaker.

A Type 2 SPD is also a hardwired, permanently connected SPD which must be **installed after the main service** overcurrent protective device. This means it must be installed on the load side of the main breaker.

Type 3 SPDs **are point-of-use devices** and are still recommended for the protection of computers, TV's and other electronic devices, but are outside the scope of the Article 230.67 requirements and cannot be used to comply with the provisions of this section.

230.71(A)(B) Maximum Number of Disconnects
Revised: For the purpose of this section, disconnecting means installed as part of listed equipment and used solely for the following shall not be considered a service disconnecting means:

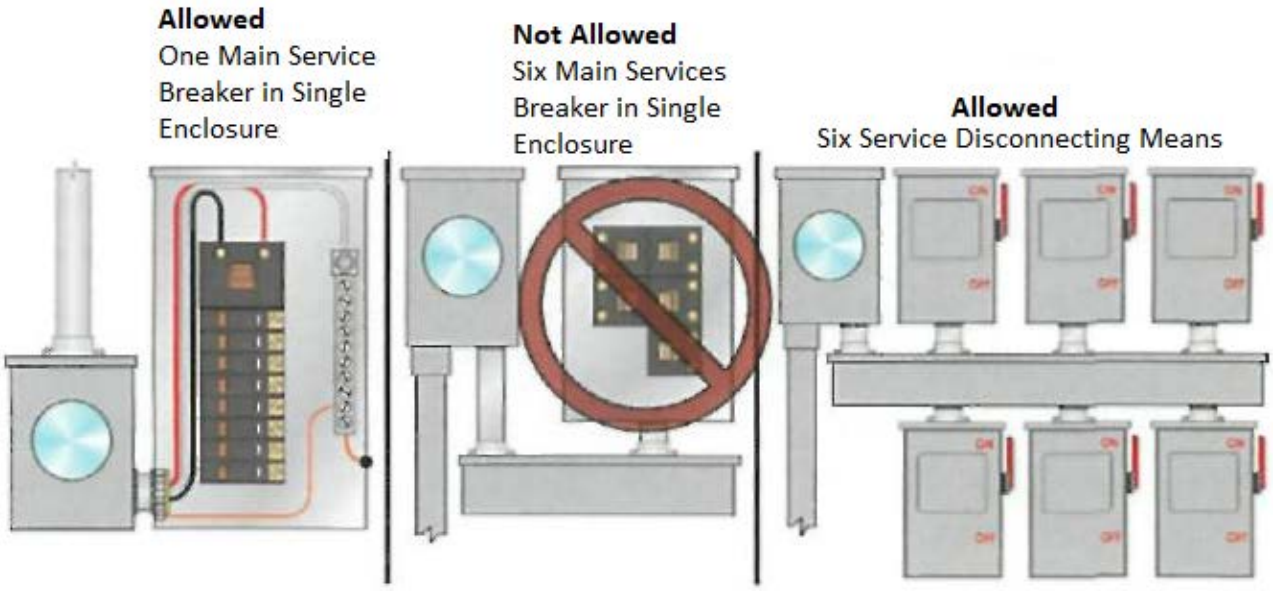
(1) Power monitoring equipment
(2) Surge-protective device(s)
(3) Control circuit of the ground-fault protection system
(4) Power-operable service disconnecting means

(B) Two to six service disconnects Means: Two to six service disconnects shall be permitted for each service permitted by 230.2 or for each set of service-entrance conductors permitted by 230.40, Exception No. 1, 3, 4, or 5. The two to six service disconnecting means shall be permitted to consist of a combination of any of the following:

(1) Separate enclosures with a main service disconnecting means in each enclosure
(2) Panelboards with a main service disconnecting means in each panelboard enclosure
(3) Switchboard(s) where there is only one service disconnect in each separate vertical section where there are barriers separating each vertical section
(4) Service disconnects in switchgear or metering centers where each disconnect is located in a separate compartment

Comment: This requirement for allowing six means of disconnect in a single enclosure or in up to six separate enclosures has been a part of the Code since the 1937 edition of the NEC. This revision of 230.71 retains the six means of disconnect for services, but now requires that these up to six means of disconnect be **installed in separate enclosures.**

This is a SAFETY ISSUE. Consider the safety aspect that an electrician may encounter when working in a panelboard with more than one service disconnecting means. The six means of disconnect for a single enclosure **makes it impossible** to work in service equipment when applying electrically safe work practices in accordance with NFPA 70E (Standard for Electrical Safety in the Workplace). A single service disconnect within the service equipment **facilitates the ability** to create an electrically safe work condition by opening the single service disconnect.



230.85 Exterior Emergency Disconnects) for Dwelling Units

New: For one- and two-family dwelling units, all service conductors shall terminate in disconnecting means having a short-circuit current rating equal to or greater than the available fault current, installed in a readily accessible outdoor location. If more than one disconnect is provided, they shall be grouped. Each disconnect shall be one of the following:

(1) Service disconnects marked as follows:
EMERGENCY DISCONNECT,
SERVICE DISCONNECT

(2) Meter disconnects installed per 230.82(3) and marked as follows:
EMERGENCY DISCONNECT,
METER DISCONNECT,
NOT SERVICE EQUIPMENT

(3) Other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment and marked as follows:
EMERGENCY DISCONNECT,
NOT SERVICE EQUIPMENT

NEC 230.85 now requires an Emergency disconnect for one-and two family dwelling units

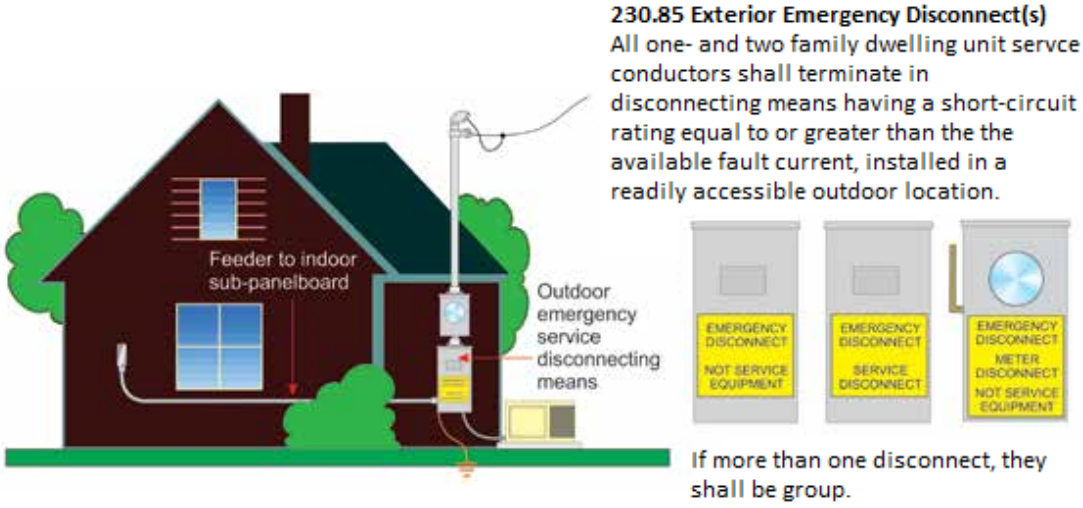
Markings shall comply with 110.21(B).

Comment: The 2020 NEC now requires an emergency disconnecting means for a one- or two-family dwelling located on the outside of the structure. Also the rapid shutdown of a PV system is still required to be installed at a readily accessible location outside the building for one-family and two-family dwellings.

This outdoor emergency disconnect can consist of a:
(1) Properly marked service disconnect,
(2) Properly marked meter disconnect installed per 230.82(3),
(3) Meter disconnect(s), or other listed disconnect switches or circuit breakers on the supply side of each service disconnect that are suitable for use as service equipment.

All of these options must be properly marked to indicate that they are service disconnects, emergency disconnects, etc. with the marking in compliance with 110.21(B).

This requirement is based on the first responders having access to an emergency service disconnecting means in an emergency situation such as a fire, gas leak, structural damage, or flooding. Access to the service disconnecting means for fire department personnel first responders is very challenging when the service disconnect is installed in an indoor location of a dwelling unit area such as a basement.



For more Information:

METER SOCKET WITH BYPASS SWITCH EXPLAINED

I have been ask if a **meter socket bypass switch** could be used as the emergency disconnecting for service conductor as required in 230.85 of the 2020 NEC. To help remove some confusion of I have added some information below to help clear it up. Part of this article is Excerpt from the IAEI and NESC (the utility's code).

Meter with Level Bypass Switch

Question:
Can a Bypass Switch be used as a Disconnecting means for service equipment?

Answer: A meter can with a **"bypass switch"** is not the way to disconnect everything on a service. A **"bypass switch"** bypasses the meter socket so that the meter can be removed during maintenances of the meter.

This is done typically for commercial establishments so that the utility is able to upgrade/replace their meter without requiring the commercial tenant to shut their business down. So for non-residential occupancies we install a socket with something called a **"lever bypass.** In these cans there is a lever that is connected to a mechanical means of releasing pressure on the meter's terminals while shorting each the line side to the load side of the socket to maintain service while the meter is removed. Then in residential occupancies we install a socket with something called a **"horned bypass".** In these cans there is a tab on each lug on which jumpers can be installed while the meter is replaced to maintain service while the meter is removed.

How does Bypass Switch work:
Level Bypass:
Lever Bypass is available for use with ringless style single or three phase metering equipment and is supplied with a swing arm or **"Lever"** extending from the right side of the meter socket. Once the ringless meter socket cover is removed, this dual function Lever may be manually rotated upward to engage bypass rotor blades into line and load bypass jaws allowing current to flow through the meter socket with the meter in or out of the meter socket. The second feature this Lever provides is a jaw release function. By rotating the Lever up as far as possible the spring loaded meter socket jaws are spread open for ease of meter installation or removal. This temporary bypass feature allows the utility to perform meter MAINTENANCE without interruption of service to the downstream occupant.

Horn-Bypass: A Horn Bypass is available for use with ringless style, single phase out, metering equipment and requires the use of utility supplied jumper cables that may be installed once the outer ringless cover is removed from the meter socket. Short bus connectors extend upward from the line side and downward from the load side meter socket jaws. The ends of these bus connectors give the appearance of "Horns". One jumper cable per phase is manually installed by a qualified service technician creating a path for current to flow once the meter is removed from the socket. This temporary bypass feature allows the utility to perform meter MAINTENANCE without interruption of service to the downstream occupant.

240.6(C) Standard Ampere Ratings "Restricted Access Adjustable Trip Circuit Breakers"
New: A circuit breaker(s) that restricted access to the adjusting means shall be permitted to have an ampere rating(s) that is equal to the adjusted current setting (long-time pickup setting). Restricted access shall be achieved by one of the following methods:

(1) Located behind removable and scalable covers over the adjusting means.
(2) Located behind bolted equipment enclosure doors
(3) Located behind locked doors accessible only to qualified personnel
(4) Password protected, with password accessible only to qualified personnel

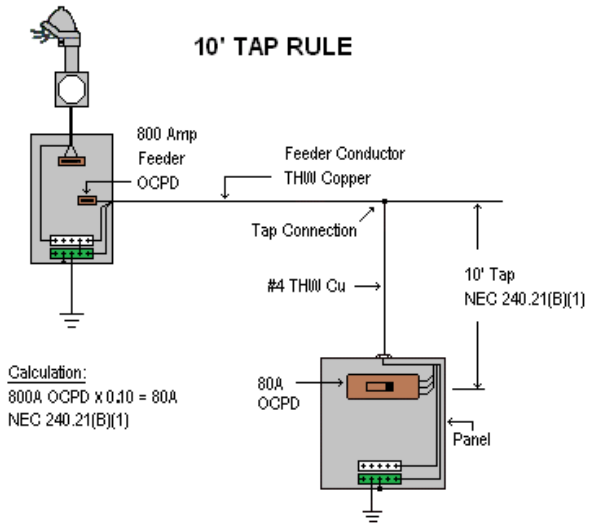
Comment: The adjustable settings on an adjustable-trip circuit breaker need to be protected from inadvertent settings out of the desired operational settings.

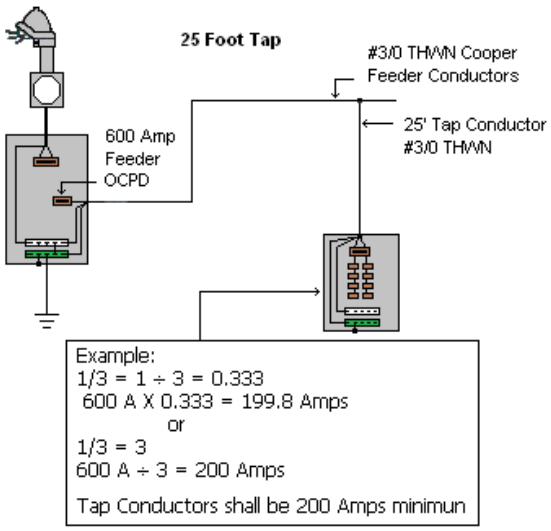
240.21(B) Feeder Taps
Revised: Conductor shall be permitted to be tapped, without overcurrent protection at the tap, to a feeder as specified in 240.21(B)(1) through (B)(5). The tap shall be permitted as any point on the load side of the feeder overcurrent protection device. Section 240.4(B) shall not be permitted for tap conductors.

(1) Taps Not over 3 m (10 ft) Long
Rules: Tap NOT more than 10 feet long,
Tap NOT less than one tenth the size of the Feeder OCPD,
Tap shall termination in OCPD,
Tap shall NOT be rated less than the Tap OCPD.

(2) Taps Not over 7.5 m (25 ft) long
Rules: Tap NOT more than 25 feet long,
Tap NOT less than one third the size of the Feeder OCPD,
Tap shall termination in OCPD,
Tap shall NOT be rated less than the Tap OCPD.

Comment: The tap rule makes it clear that the tap can be located at any point on the load side of the feeder overcurrent protection device. NEC 2017 did not make it clear.





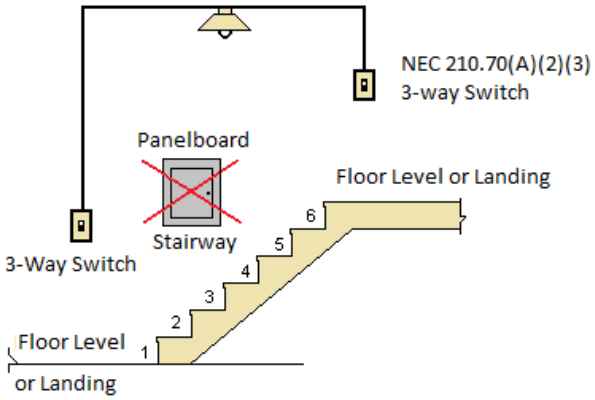
240.24(F) Overcurrent Protection Devices (Not located over Steps)

Review: This is a new requirement that makes it clear that "Overcurrent Protection Devices" shall NOT be located over the rises (steps) of a stairway. The reason for this is the electrician needs a level workplace to work off".

Comment: Many stairways have horizontal landings that could be suitable for installations, where appropriate working space exists. See NEC 110.26(A)(1)

Locations that are prohibited to panelboard installations are:

1) Exposed to physical damage – NEC 240.24(C)
2) Clothes closets – NEC 240.24(D)
3) Bathrooms – NEC 240.24(E)



240.87(A)(B) Arc Energy Reduction

Revised: (A) Documentation shall be available to those authorized to design, install, operate, or inspect the installation as to the location of the circuit breaker(s). Documentation shall also be provided to demonstrate that the method chosen to reduce clearing time is set to operate at a value below the available arcing current.

(B) Method to Reduce Clearing Time. One of the following means shall be provided and shall be set to operate at less than the available arcing current:

(1) Zone-selective interlocking
(2) Differential relaying
(3) Energy-reducing maintenance switching with local status indicator
(4) Energy-reducing active arc flash mitigation system
(5) An instantaneous trip setting. ~~that is less than the available arcing current.~~ Temporary adjustment of the instantaneous trip setting to achieve arc energy reduction shall not be permitted.
(6) An instantaneous override ~~that is less than the available arcing current~~
(7) An approved equivalent means

Comment: Arc energy reduction is designed to limit the arc-flash energy to which electrical workers or maintenance personnel could be exposed when working on the load side of an overcurrent devices that is rated or can be adjusted to 1200 amperes or higher. These requirements are industry-proven methods to reduce arc-flash injuries that provide a method to reduce the amount of time a fault will be permitted to persist on the electrical system.

There are seven proven methods in 240.87(B) for reducing clearing times for circuit breakers that are rated or can be adjusted when 1200 amperes or higher. The fifth method involves an **instantaneous trip setting on a circuit breaker** that is less than the available arcing current.

The 2020 NEC clarifies that a temporary adjustment of the instantaneous trip setting to achieve arc energy reduction does not satisfy this requirement. This change also clarifies that it is the final setting of the instantaneous trip that determines whether or not additional arc energy reduction techniques are required. It is not the intention of this requirement that the minimum setting of the instantaneous trip (as is typically shipped from the factory) be the determining factor on whether or not additional arc energy reduction is necessary, but rather the final setting as determined by the electrical system requirements such as inrush characteristics or selective coordination. Furthermore, arc energy reduction is not achieved with an instantaneous trip being adjusted to a lower setting while a worker is working on the equipment, and then adjusted back to the desired setting after the work is complete.

NEW 242 Overvoltage Protections

New Article: This new proposed article provides the general, installation, and connection require ments for overvoltage protection and overvoltage protective devices. Part II covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1,000 volts, nominal. Part III covers surge arresters permanently installed on premises wiring systems over 1,000 volts, nominal. A lot of this information was relocated from existing Articles 280 and 285.

Comment: This new article combines the requirements of Article 280, which covered Surge Arresters, and 285, which covered Surge-Protective Devices (SPDs). These two articles were deleted while a new Article 242 was developed and acted upon by *Code* -Making Panel 10.

This new article provides general, installation, and connection requirements for overvoltage protection and overvoltage protective devices. These requirements are after Article 240 for over-current protection.

When the voltage in a circuit is increased above its upper design limits, it is known as "**overvoltage**" and this condition may be hazardous. It can be caused by voltage spike or a power surge from a lightning strike, Etc. These overvoltage's can be protected through the use of "Arcing Horns" devices attached to a transmission lines or "Surge Protected Device or Surge Arrestors" use on branch circuits or feeders.

What is the difference between Type 1 and Type 2 SPDs?

Type 1 SPD is a hardwired, permanently connected SPD which may be installed on the utility side of the main service overcurrent protective device (i.e. before the main breaker at the service), or it may be installed after the main breaker. The Type 1 SPD can be installed on the line side or load side of the main breaker.

Type 2 SPD is also a hardwired, permanently connected SPD which must be installed after the main service overcurrent protective device. This means it must be installed on the load side of the main breaker.

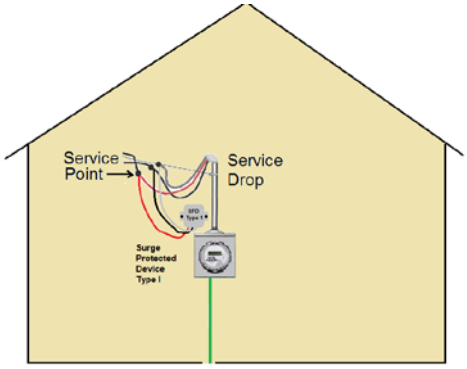
Type 3 SPDs are point-of-use devices and are still recommended for the protection of computers, TV's and other electronic devices, but are outside the scope of the Article 230.67 requirements and cannot be used to comply with the provisions of this section.

Surge Protector Used Where

They are used in service entrance, downstream panel board, and to make clean supply of power to solid state equipment. A surge protector performs well for your expensive equipment, used in your home or office, including in hospitals and other critical areas.

Surge Arrester Used Where

The surge arrester is best to protect insulation of transformers, panel boards, and wirings. However, it doesn't work well for solid state components. When it comes to protection of large equipment like transformers that work under high voltage, surge arresters are best.



Part II of this article covers surge-protective devices (SPDs) permanently installed on premises wiring systems of not more than 1000 volts, nominal.

Part III of this article covers surge arresters permanently installed on premises wiring systems over 1000 volts, nominal.

Type of Surge-Protective Devices

Type 1 SPD: Is connected between the secondary of the service transformer and the line side of the service disconnecting.

Type 2 SPD: Is connected anywhere on the load side of the service disconnecting.

Type 3 SPD: Is connected on the load-side of the service OCPD or branch-circuit protection up to the equipment served.

Type 4 SPD: is installed only by the equipment manufactures.

NOTE: Always follow the manufactures instructors.

250 Meter Service and Panel Code Requirements Detail