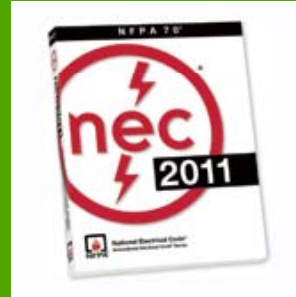


2011 National Electrical Code Changes

Alan Manche, P.E.
Director, Industry Standards



Schneider
Electric

2011 NEC Facts

- 5,016 public proposals
- 2,910 public comments
- 22 Certified Amending Motions at the NFPA Annual Meeting (7 were successful on the floor)
- 7 appeals to the Standards Council (all were denied)
- Issued by the NFPA Standards Council in August 2010 with an effective date of August 25, 2010
- Timing of the adoption of the NEC will vary by state and local jurisdiction

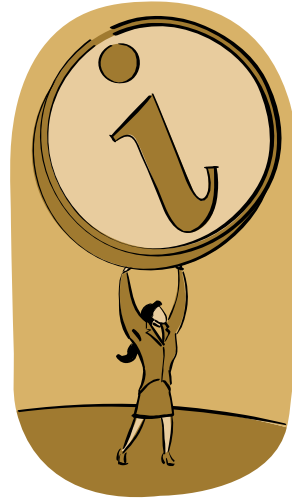
90.5(C) and (D) – Explanatory Material and Annexes

- **Fine Print Notes are now Informational Notes**

- FPN No.1..... Becomes..... Informational Note No. 1
- Information only and not enforceable as part of the code rules

- **New (D) added for Informative Annexes**

- Annexes A thru I are included for informational purposes and are not enforceable as part of the code rules



90.2(B)(5)(d) – Scope, Not Covered

- **Revised to add reference to “written agreements” to permit exemption of utility installations from code requirements**

- **Limited to:**

- Purpose of communications, metering, generation, control, transformation, transmission, or distribution of electric energy where legally established easements or rights-of-way cannot be obtained
- Federal lands, native American reservations, military bases, lands controlled by port authorities and state agencies and lands owned by railroads



Article 100 – “Automatic”/ “Nonautomatic”

- **Automatic**

- Performing a function without the necessity of human intervention

- **Non Automatic**

- Requiring human intervention to perform a function



Article 100 - Bathroom

An area consisting of a:



Toilet



Urinal



Basin

Plus one or more of



Tub



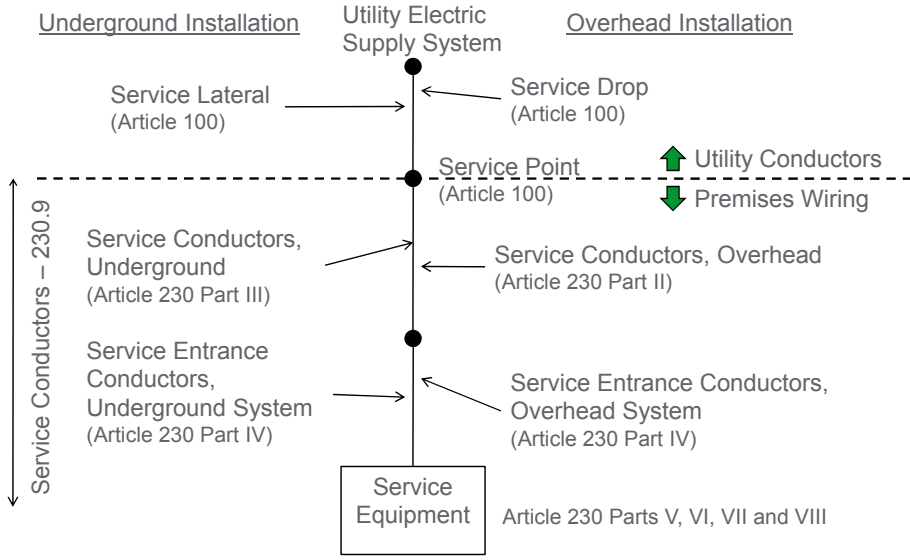
Shower



Bidet

or similar plumbing fixture

Article 100 – Service Definitions



110.3(A)(1) – Examination of Equipment

● **Informational Note revised to indicate that additional limitations may be found in:**

- Product instructions
- Included with the listing and labeling information

- *Do not connect circuit breaker to more than 250 ft. (76 m) of load conductor for the total one-way run.*



NEC 110.14 – Electrical Connections

- Connectors and terminals for conductors more finely stranded than Class B and Class C stranding as shown in Chapter 9, Table 10, shall be identified for the specific conductor class or classes.

Table 10 – Conductor Stranding

Conductor Size		Number of strands		
AWG or kcmil	(mm ²)	Copper		Aluminum
		Class B	Class C	Class B
24 – 30	0.20 – 0.05	^a	–	–
22	0.32	7	–	–
20	0.52	10	–	–
18	0.82	16	–	–
16	1.3	26	–	–
14 – 2	2.1 – 33.6	7	19	7 ^b
1 – 4/0	42.4 – 107	19	37	19
250 – 500	127 – 253	37	61	37
600 – 1000	304 – 508	61	91	61
1250 – 1500	635 – 759	91	127	91
1750 – 2000	886 – 1016	127	271	127

^a Number of strands vary.
^b Aluminum 14 AWG (2.1 mm²) is not available.



110.24 - Available Fault Current

- (A) Service equipment to be marked in the field with the maximum available fault current.
 - Excludes Dwellings
 - Must include date the fault current calculation was performed
 - Sufficient durability to withstand the environment
- (B) Modifications
 - Must verify or recalculate the value
 - Adjust marking if necessary

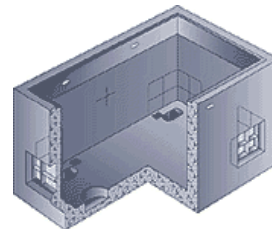


110.28 Enclosure Types

- List of equipment to be marked with an enclosure-type expanded
- 110.28 relocated from 110.20
- Enclosures of switchboards, panelboards, industrial control panels, motor control centers, meter sockets, enclosed switches, transfer switches, power outlets, circuit breakers, adjustable-speed drive systems, pullout switches, portable power distribution equipment, termination boxes, general purpose transformers, fire pump controllers, fire pump motors, and motor controllers shall be marked with an enclosure-type number as shown in Table 110.28

110.31(A) – Electrical Vaults

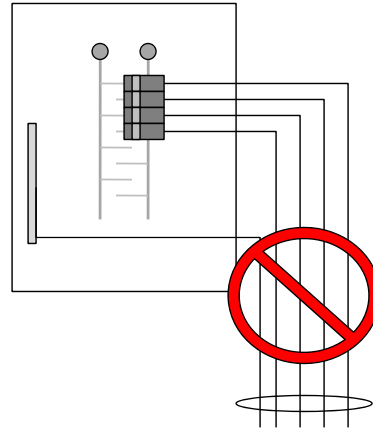
- Where a vault is required or specified for over 600V the section applies
- Construction
 - Walls and roof – 3 hour construction
 - Floors – not less than 4" thick, if constructed on upper floors must have a 3 hr rating
 - Doors – tight fitting with 3 hr rating
 - Can move to 1 hr rating if the vault is protected with automatic fire suppression
- Doors must be equipped with locks
- Transformer vaults must comply with Article 450



200.4 – Neutral Conductors

● Prohibits a single neutral conductor for:

- More than one branch circuit
- More than one multi-wire branch circuit
- More than one set of ungrounded feeder conductors unless specifically permitted elsewhere in the code



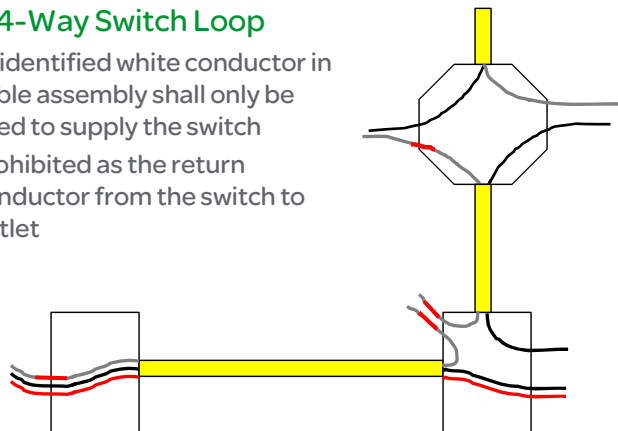
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13

200.7(C)(1) – White Conductor Identification

● 3 or 4-Way Switch Loop

- Reidentified white conductor in cable assembly shall only be used to supply the switch
- Prohibited as the return conductor from the switch to outlet



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14

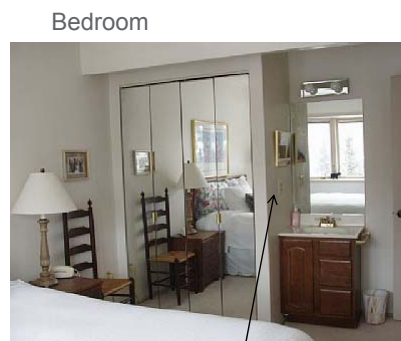
210.8 – GFCI Accessibility

- The GFCI shall be installed in a readily accessible location
- Circuit breaker GFCIs are, by default, readily accessible because of requirements in 240.24(A)
- Caution must be used in placing GFCI receptacles where they may be blocked by items such as:
 - Furniture
 - Refrigerators
 - Vending machines



210.8(A)(7) – Sinks (Dwelling Units)

- GFCI protection is required for all receptacles installed within 6' of any sink
- Kitchens are still covered by 210.8(A)(6)
- No exceptions for fixed equipment of special loads



GFCI required

210.8(B) – GFCI Additions (other than dwelling units)

(6) Indoor wet Locations

(7) Locker rooms with associated showering facilities

(8) Garages, service bays, and similar areas where electrical diagnostic equipment, electrical hand tools, or portable lighting equipment are to be used



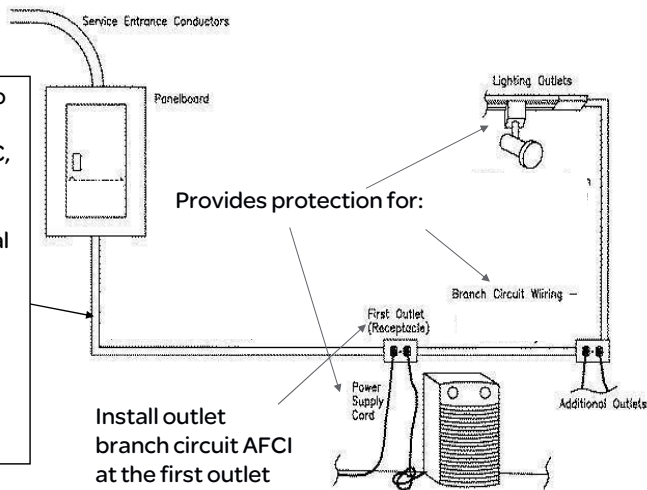
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17

210.12(A) Ex #1 and #2– AFCI at the 1st Outlet

Wiring from panel to first outlet must be installed in RMC, IMC, EMT, MC or steel jacketed AC cable. Must also have metal outlet and junction boxes.

Also permits nonmetallic conduit where encased in 2" of concrete



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18

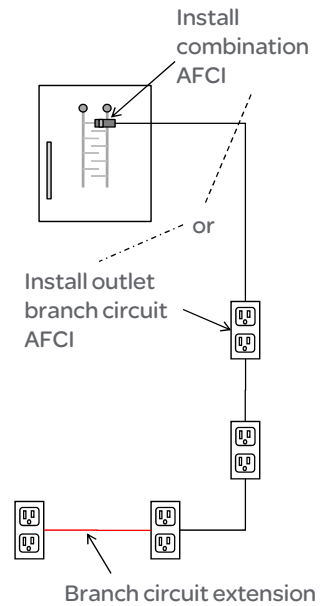
210.12(B) – Branch Circuit Extensions or Modifications (dwelling units)

- Requires that AFCI protection be provided where:

- Branch circuit wiring is modified, replaced or extended
- Applies to branch circuits in any of the areas specified in 210.12(A)

- The protection can be a combination AFCI at the origin of the branch circuit, or;

- It can be an Outlet Branch Circuit AFCI at the first receptacle outlet of the branch circuit



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19

210.52(A)(2)(1) – Wall Space

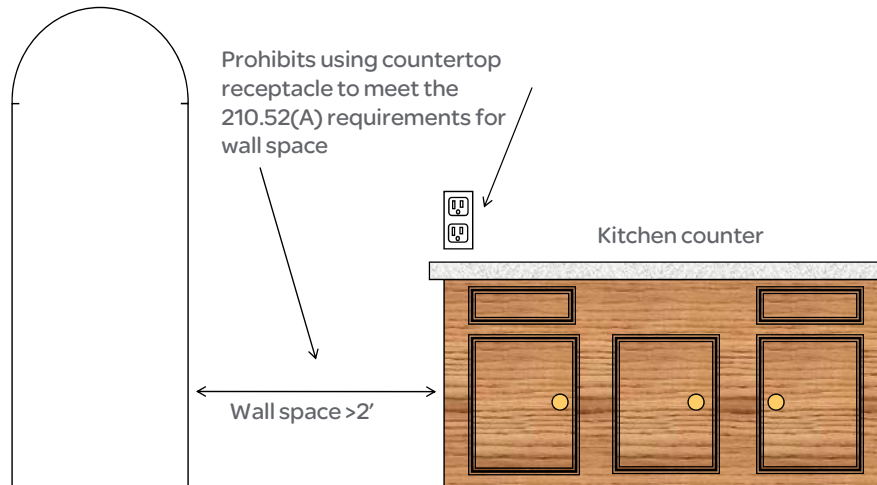
- Permits exclusion of fixed cabinets from wall space determination



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20

210.52(A)(4) – Countertop Receptacles



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21

210.52(E)(3) – Balconies, Decks and Porches

- Removes exception for small balconies, decks or porches
- At least one receptacle is required to be installed



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22

210.52(G) – Accessory Buildings (one family dwellings)

- A receptacle is required to be installed in an accessory building if electric power is provided to the accessory building



210.52(I) - Foyers

- Requires receptacles to be installed in foyers:
 - Foyer area greater than 60 sq ft
 - Foyer is not part of a hallway
 - Required at each wall space 3' or more in width (unbroken by doorways, floor to ceiling windows, etc.)



220.43(B) Exception – Track Lighting

- Example: 100' of 120V track lighting protected by a 20A overcurrent device



- 2008 NEC Feeder Load

- $(100/2\text{ft}) \times 150\text{VA} = 7,500\text{VA}$

- 2011 NEC Feeder Load

- $20\text{A} \times 120\text{V} = 2,400\text{VA}$



Calculation permitted to be based on the device that limits current to the track – could be the branch protective device or a supplemental device.

225.27 – Raceway Seal

- Raceways entering a building from an underground distribution system shall be sealed

- Spare raceways must also be sealed
- Sealant to be identified for use with cable



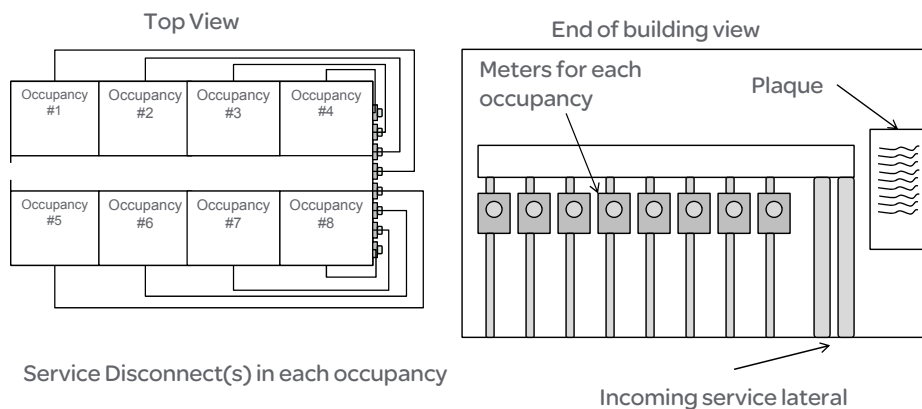
230.40 Exception No.1 – Number of Service Entrance Conductor Sets

- Buildings with more than one occupancy can have service entrance conductors run to each occupancy
- If the number of disconnect locations does not exceed six:
 - 230.2(E) applies (plaques or directory at each service disconnect location)
- If number of disconnect locations exceeds six:
 - All service along with any feeder or branch supplies must be clearly described using suitable graphics, text or both.
 - Plaque must be located in an approved, readily accessible location on the building or structure
 - Near as practicable to the point of attachment or entries for each service drop or lateral and for each set of overhead or underground service conductors

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27

230.40 – Exception No. 1



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28

240.87 - Non-instantaneous Trip

- Requires additional measures be installed where a circuit breaker without an instantaneous trip function is used
- Requires one of the following or an approved equivalent:
 - (1) Zone-selective interlocking
 - (2) Differential relaying
 - (3) Energy-reducing maintenance switching with a local status indicator



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29

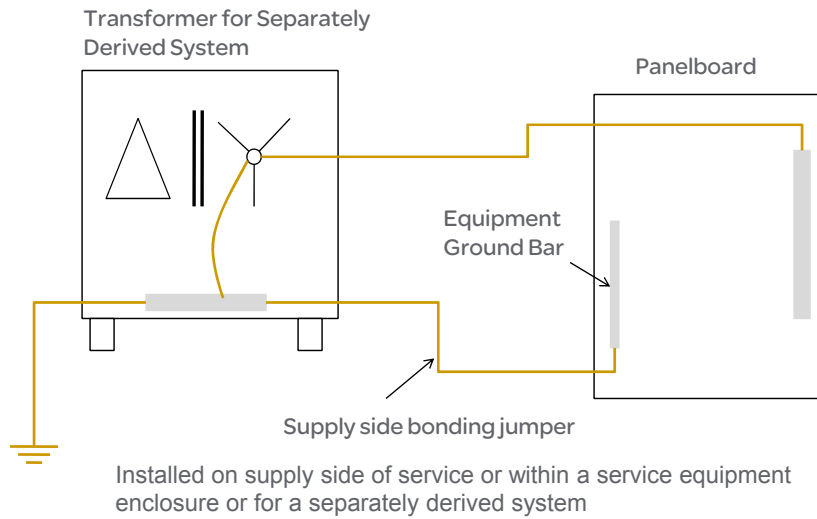
240.91(B) – Devices Rated Over 800 Amperes

- Applies in Supervised Industrial Locations Only
- Permits rounding up of overcurrent devices rated over 800A where:
 - The ampacity of the conductors protected by the device are 95% or greater of the rating of the device
 - The conductors are protected within recognized time vs. current limits for short circuit currents
 - All equipment in which the conductors terminate is **listed and marked** for the application
- Issues:
 - There are no products for this application
 - There are no standards developed to support the listing and marking
 - Utilization of smaller conductors raises the operating temperature of the equipment

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30

250.2 – Supply Side Bonding Jumper



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31

250.21(C) – Marking (ungrounded systems)

● Marking for ungrounded systems:

- Be marked “Ungrounded System”
- At the source or first disconnecting means of the system
- Sufficient durability to withstand the environment



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32

250.30(C) – Outdoor Source

- If source of separately derived system is located outside building or structure:

- Grounding electrode connection must be made at the source location
- Grounding electrode must comply with 250.50



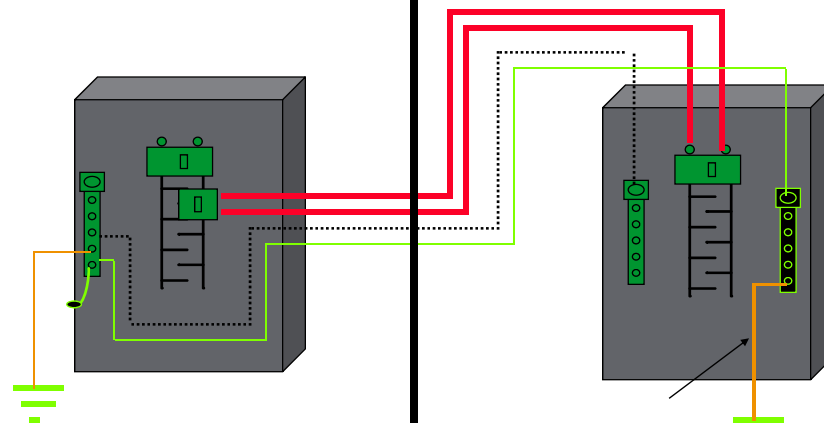
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33

250.32(B) – Two or More Buildings/Structures

Service Equip - Bldg #1

Bldg #2



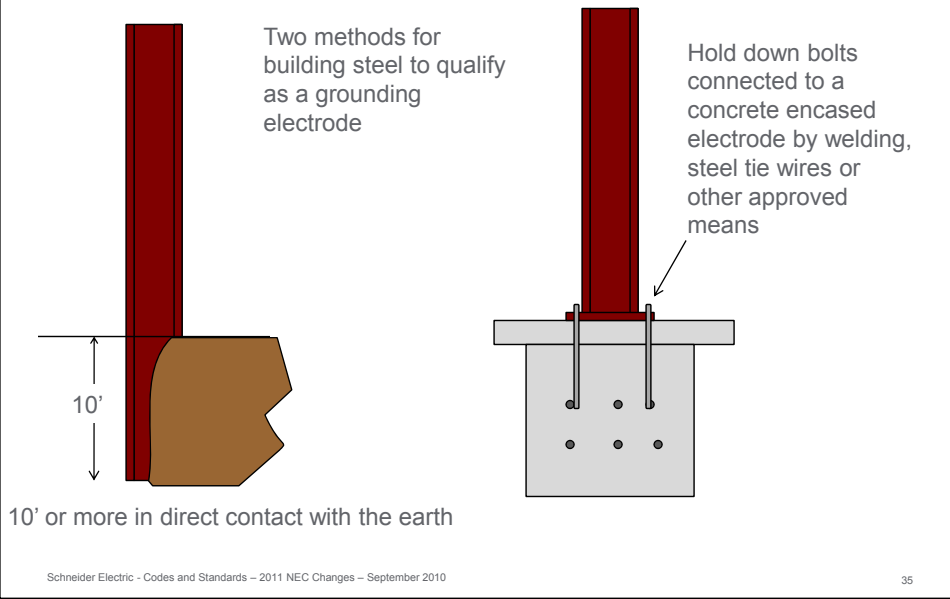
Ex: **Existing Installations** still permit bonding of grounded conductor at second building meeting 3 conditions

- 1) No EGC
- 2) No continuous metal path
- 3) GFPE not installed on supply side

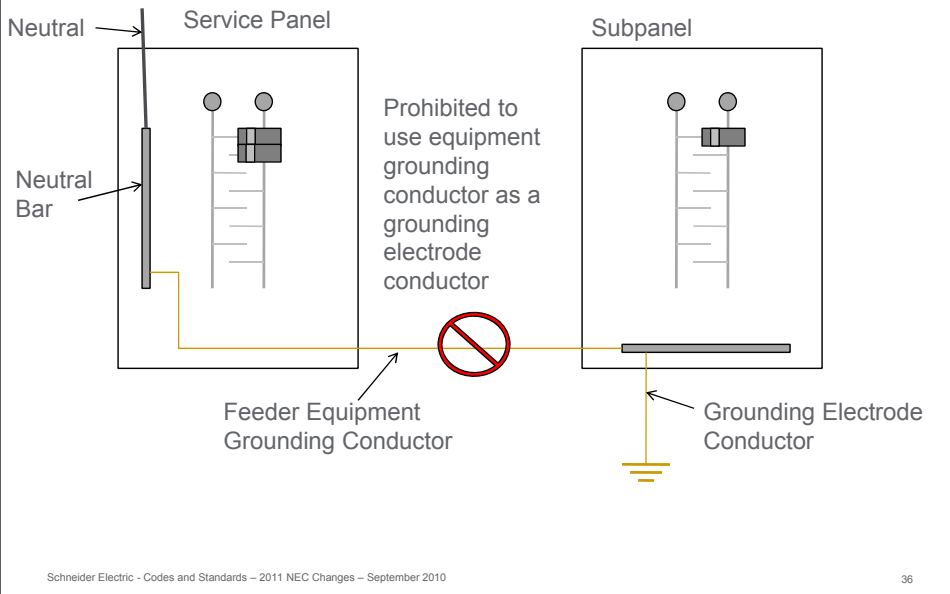
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34

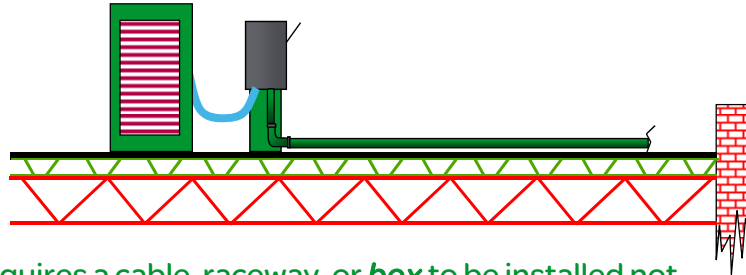
250.52(A)(2) – Metal Frame of Building or Structure



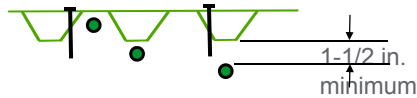
250.121 – Use of Equipment Grounding Conductors



300.4(E) – Raceways Under Roof Decking



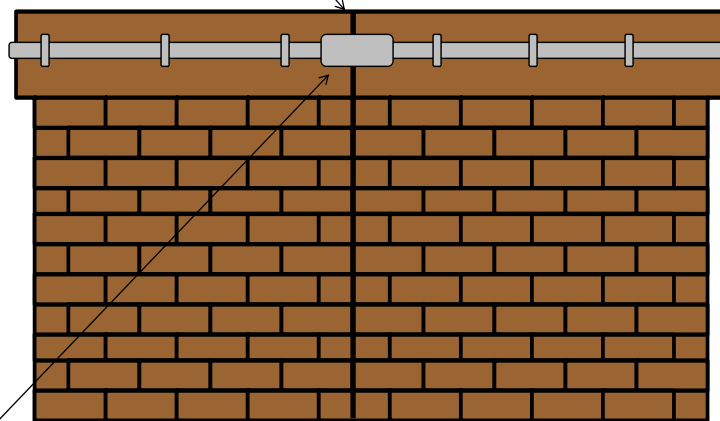
- Requires a cable, raceway, or **box** to be installed not less than 38 mm (1½ in.) from the nearest surface of the metal-corrugated sheet roof decking.



RMC and IMC are not required to comply with the spacing

300.4(H) – Structural Joints

Structural joint intended for expansion, contraction or deflection



Listed expansion/deflection fitting or other approved means

Ampacity Tables Renumbered

- Extensive renumbering of the tables and related sections
- 310.15(B)(2)(a) → 310.15(B)(3)(a)
- 310.15(B)(2)(c) → 310.15(B)(3)(c)
- 310.15(B)(6) → 310.15(B)(7)
- 310.16 → 310.15(B)(16)

Table 310.15(B)(3) (formerly Table 310.16) Allowable Ampacity of Insulated Conductors Based Upon and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Four (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

Size AWG or kcmil	Temperature Rating of Conductors (See Table 310.104(A))						Size AWG or kcmil
	60°C (140°F)		75°C (167°F)		90°C (194°F)		
	THHN, THWN-2, THWN, THWN-2, THWN-2, THWN-2	THHN, THWN, THWN, THWN-2, THWN-2, THWN-2	THHN, THWN, THWN, THWN-2, THWN-2, THWN-2	THHN, THWN, THWN, THWN-2, THWN-2, THWN-2	THHN, THWN, THWN, THWN-2, THWN-2, THWN-2	THHN, THWN, THWN, THWN-2, THWN-2, THWN-2	
14	25	30	35	40	45	50	14
12	30	35	40	45	50	55	12
10	35	40	45	50	55	60	10
8	40	45	50	55	60	65	8
6	45	50	55	60	65	70	6
4	50	55	60	65	70	75	4
3	55	60	65	70	75	80	3
2	60	65	70	75	80	85	2
1	65	70	75	80	85	90	1
1/2	70	75	80	85	90	95	1/2
1/0	80	85	90	95	100	105	1/0
1/2	90	95	100	105	110	115	1/2
3/4	100	105	110	115	120	125	3/4
1	110	115	120	125	130	135	1
1 1/4	125	130	135	140	145	150	1 1/4
2	150	155	160	165	170	175	2
3	175	180	185	190	195	200	3
4	200	205	210	215	220	225	4
5	225	230	235	240	245	250	5
6	250	255	260	265	270	275	6
7	275	280	285	290	295	300	7
8	300	305	310	315	320	325	8
9	325	330	335	340	345	350	9
10	350	355	360	365	370	375	10
11	375	380	385	390	395	400	11
12	400	405	410	415	420	425	12
14	450	455	460	465	470	475	14
16	500	505	510	515	520	525	16
18	550	555	560	565	570	575	18
20	600	605	610	615	620	625	20
24	700	705	710	715	720	725	24
30	850	855	860	865	870	875	30
36	1000	1005	1010	1015	1020	1025	36
42	1150	1155	1160	1165	1170	1175	42
50	1350	1355	1360	1365	1370	1375	50
60	1600	1605	1610	1615	1620	1625	60
75	1950	1955	1960	1965	1970	1975	75
90	2300	2305	2310	2315	2320	2325	90
110	2700	2705	2710	2715	2720	2725	110
140	3300	3305	3310	3315	3320	3325	140
175	4050	4055	4060	4065	4070	4075	175
220	4950	4955	4960	4965	4970	4975	220
280	5900	5905	5910	5915	5920	5925	280
350	7000	7005	7010	7015	7020	7025	350
440	8250	8255	8260	8265	8270	8275	440
550	9600	9605	9610	9615	9620	9625	550
700	11250	11255	11260	11265	11270	11275	700
875	13125	13130	13135	13140	13145	13150	875
1100	15300	15305	15310	15315	15320	15325	1100
1400	17850	17855	17860	17865	17870	17875	1400
1750	20700	20705	20710	20715	20720	20725	1750
2200	23900	23905	23910	23915	23920	23925	2200
2800	28350	28355	28360	28365	28370	28375	2800
3500	34050	34055	34060	34065	34070	34075	3500
4400	40050	40055	40060	40065	40070	40075	4400
5500	46350	46355	46360	46365	46370	46375	5500
7000	54000	54005	54010	54015	54020	54025	7000
8750	63000	63005	63010	63015	63020	63025	8750
11000	73500	73505	73510	73515	73520	73525	11000
14000	85500	85505	85510	85515	85520	85525	14000
17500	99000	99005	99010	99015	99020	99025	17500
22000	114000	114005	114010	114015	114020	114025	22000

†Based on 310.15(B)(2) but the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

**Based on 240.4(B) for conductor ampacity correction factors.

310.15(B)(3)(a) – More than Three Current Carrying Conductors

- Requires that all conductors in the raceway or cable be counted
 - Adjusted for 310.15(B)(5) – conductors that carry only imbalance
 - Adjusted for 310.15(B)(6) – grounding and bonding conductors
- Previous exceptions have been turned into positive language

Table 310.15(B)(3)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of Conductors ¹	Percent of Values in Table 310.15(B)(16) through Table 310.15(B)(19) as Adjusted for Ambient Temperature if Necessary
4–6	80
7–9	70
10–20	50
21–30	45
31–40	40
41 and above	35

¹Number of conductors is the total number of conductors in the raceway or cable adjusted in accordance with 310.15(B)(5) and (6).

310.15(B)(16) – Allowable Ampacity Table

- A few conductor ampacities have been adjusted to harmonize with the CEC
- Ambient correction factors have been moved to their own table [310.15(B)(2)(a)]

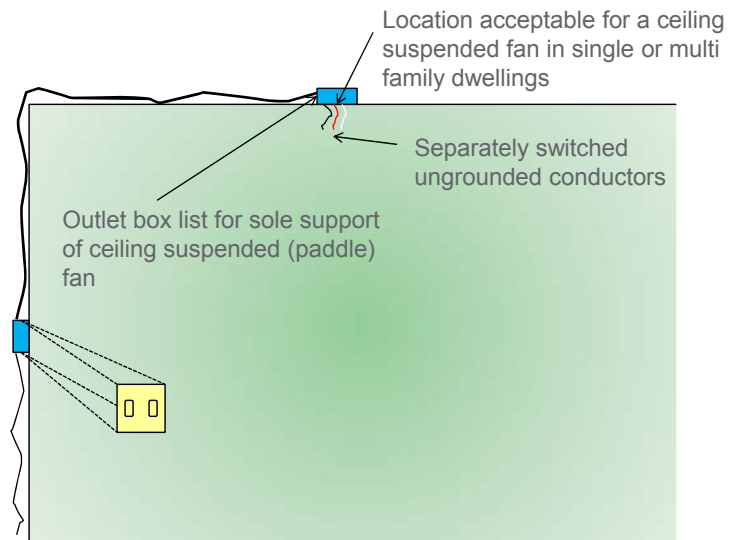
Table 310.15(B)(16) (formerly Table 310.16) Allowable Ampacities of Insulated Conductors Rated Up to and Including 2000 Volts, 60°C Through 90°C (140°F Through 194°F), Not More Than Three Current-Carrying Conductors in Raceway, Cable, or Earth (Directly Buried), Based on Ambient Temperature of 30°C (86°F)

Size AWG or kcmil	Temperature Rating of Conductor (See Table 310.10(A).1)						Size AWG or kcmil
	60°C (140°F)	75°C (167°F)	90°C (194°F)	60°C (140°F)	75°C (167°F)	90°C (194°F)	
	Type TW, UF	Type THW, THWN, XHHW, USE-2, ZW	Types TBS, SA, SIS, FEP, FEP, XL, RHH, RHW-2, THHN, THHW, THW-2, THWN-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	Type TW, UF	Types RHW, THHW, THWN, XHHW, USE	Types TBS, SA, SIS, THHN, THHW, THW-2, THWN-2, RHH, RHW-2, USE-2, XHH, XHHW, XHHW-2, ZW-2	
COPPER							
18	—	—	14	—	—	—	—
16	—	—	15	—	—	—	—
14	13	20	25	13	—	—	—
12	20	25	30	20	20	25	12
10	30	35	40	30	30	35	10
8	40	50	55	35	40	45	8
6	55	65	75	40	50	55	6
4	70	85	95	55	65	75	4
3	85	100	110	65	75	85	3
2	95	115	130	75	90	100	2
1	110	130	145	85	100	115	1
1/2	125	150	170	100	120	135	1/2
2/3	145	175	195	115	135	150	2/3
1/0	165	200	225	130	155	175	1/0
1/2	195	250	260	150	180	205	1/2
2/0	215	255	260	170	205	230	2/0
3/0	240	285	320	190	230	260	3/0
4/0	260	310	350	210	250	300	4/0
500	280	335	380	225	270	315	500
600	320	380	430	260	310	350	600
750	380	420	475	285	340	385	750
900	400	460	520	300	375	420	900
1000	410	475	535	320	385	435	1000
1250	410	490	555	330	395	445	1250
1500	415	520	585	355	425	475	1500
1750	455	545	615	375	445	500	1750
2000	495	590	665	405	485	545	2000
1500	525	625	705	435	520	585	1500
1750	545	650	735	455	545	615	1750
2000	585	695	780	490	590	660	2000

*Refer to 310.15(B)(2) for the ampacity correction factors where the ambient temperature is other than 30°C (86°F).

**Refer to 240.4(D) for conductor ampacity protection limitations.

314.27(C) – Boxes at Ceiling Suspended (Paddle) Fan Outlets



334.10(1) – Uses Permitted (NM Cable)



One and two family dwellings



Detached garages
(of one or two
family dwellings)



Storage buildings (or one
or two family dwellings)

338.10(B)(4)(a) – Interior Installations (SE cable)

- Installation must comply with Part II of Article 334, excluding 334.80 (ampacity limitations)
- If SE cable is installed in thermal insulation, the ampacity shall be 60C
 - Still permits actual temperature rating of cable to be used for ampacity adjustment and correction



Article 399 – Outdoor, Overhead Conductors, Over 600V

- New article for the installation of outdoor overhead conductors
- NEC was lacking detailed information for installations over 600V
- Single conductors, insulated, covered or bare, installed outdoors on support structures
- 399.30 – Documentation of design
 - By licensed professional engineer
 - Engaged primarily in design of such systems
 - Spacing between conductors
 - Available upon request of AHJ

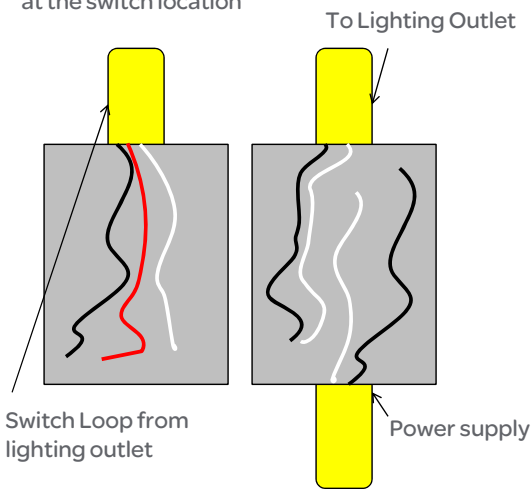


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45

404.2(C) – Switches Controlling Lighting Loads

Grounded circuit conductor shall be provided at the switch location



Raceway installations exempt if sized to accommodate extension of the grounded conductor

Not required if cable assemblies enter the box through a framing cavity that is open at top or bottom on same floor level

Not required if cable assemblies enter the box through a framing cavity that is open on one side

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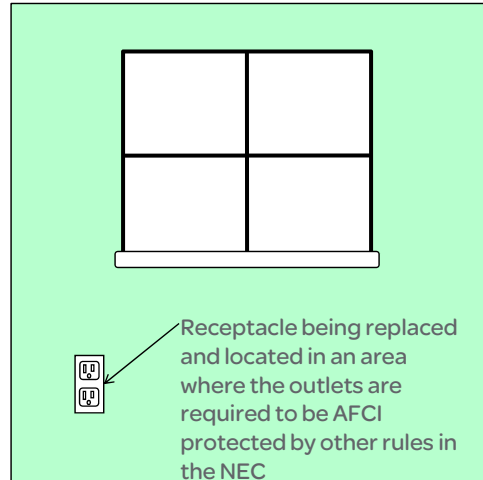
46

406.4(D)(4) – AFCI Protection

- **Must be replaced by:**

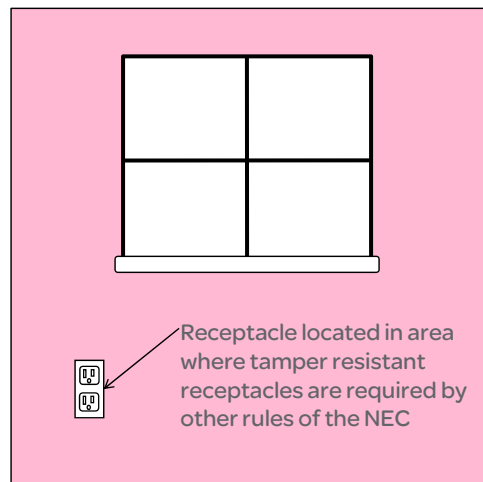
- A listed outlet branch circuit type AFCI receptacle
- A receptacle protected by a listed outlet branch circuit type AFCI receptacle
- A receptacle protected by a listed combination type AFCI circuit breaker

- **Requirement becomes effective January 1, 2014**

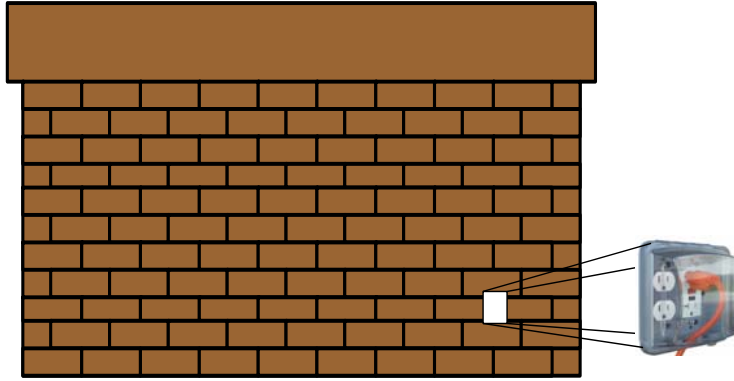


406.4(D)(5) – Tamper Resistant Receptacles

- **When replacement is made, the receptacle must be replaced with a listed tamper resistant receptacle**



406.4(D)(6) – Weather Resistant Receptacles



Requires weather resistant receptacles to be used as replacements where the receptacle is located where weather resistant receptacles are required by other NEC rules

406.9(B)(1) - 15- and 20-Ampere Receptacles in a Wet Location

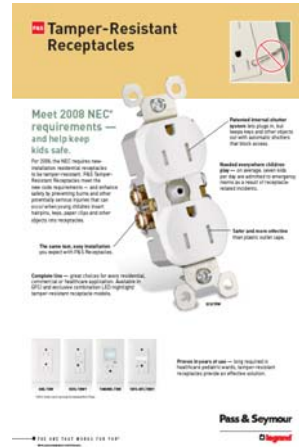
- Adds a new requirement that in other than one and two family dwellings:

- Outlet box hood must be listed
- Where installed on an enclosure supported from grade as described in 314.23(B) or 314.23(F), the hood must be identified as “extra-duty”



406.12 – Tamper Resistant Receptacles in Dwelling Units

- Adds new exception to TR requirement in dwelling units.
- TR not required on:
 - Receptacles located above 5½ feet above the floor
 - Receptacles that are part of a luminaire or appliance
 - A single receptacle or duplex receptacle for two appliances located in a dedicated space
 - Not easily moved
 - Cord and plug connected
 - Nongrounding receptacles used as replacements



406.13 – Tamper Resistant Receptacles in Guest Rooms and Guest Suites

- 125V, 15 and 20A nonlocking receptacles
- Located in guest rooms and guest suites
- Listed TR receptacles required



406.14 – Tamper Resistant Receptacles in Child Care Facilities

- Includes all child care facilities
- 125V, 15 and 20A nonlocking receptacles
- Listed TR receptacles required



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53

408.4(B) – Source of Supply (identification)

- Requires marking to indicate the device or equipment where the power supply originates
- Includes all switchboards and panelboards supplied by a feeder
- One and two family dwellings not included



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54

409.110(3) – Marking (industrial control panels)

- Panels supplied by more than one source
- If more than one disconnecting means must be opened to disconnect all power
- Panel must be marked to indicate that more than one disconnecting means is required to be operated to de-energize the equipment



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55

410.130(G)(1) – Disconnecting Means (luminaires)

- Requires installation of a disconnecting means on existing luminaires:
 - When ballast is changed and;
 - Luminaire does not have a disconnecting means installed



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56

430.22(G) – Conductors for Small Motors

●(1) - #18 AWG permitted where

- Installed in a cabinet or enclosure
- Part of jacketed multi-conductor cable or flexible cord
- Motor circuit FLA greater than 3.5 and up to 5A
 - Circuit protected by 430.52
 - Provided with minimum Class 10 overload protection
 - OCP meets 240.4(D)(1)(2)
- Motor circuit with ampacity of 3.5A or less
 - Circuit protected by 430.52
 - Provided with minimum Class 20 overload protection
 - OCP meets 240.4(D)(1)(2)



●(2) – covers #16 AWG



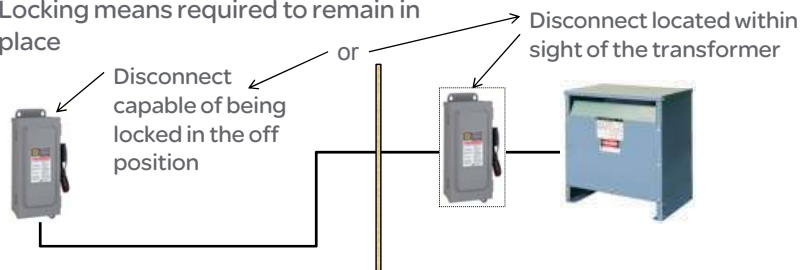
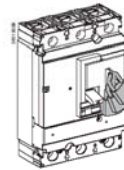
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57

450.14 – Transformer Disconnect

●A disconnecting means required for transformers

- Must be located either in sight of the transformer or
- Remotely provided with capability of being locked in the off position
- Locking means required to remain in place



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58

514 – Circuit Disconnects

514.11 – Emergency Controls

- Readily Accessible and Remote from pump

514.13 – Provisions for Maintenance

- Means shall be capable of being locked in the open position

- **Both require simultaneous disconnect for all power and communications circuits going to dispenser**

- Clarifies video and data also included



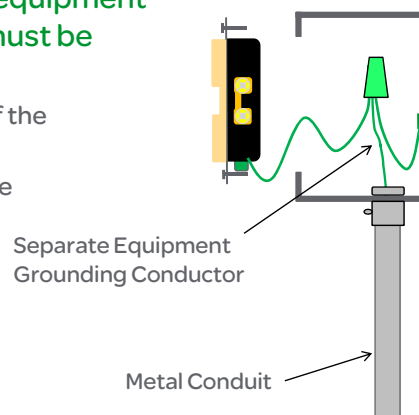
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59

517.13(B) – Grounding of Receptacles in Patient Care Areas

- **The separate insulated equipment grounding conductors must be connected to:**

- The grounding terminal of the receptacle
- The metal box or enclosure



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60

517.16 – Receptacles with Insulated Ground

- Receptacles in patient care areas prohibited to have an insulated ground terminal

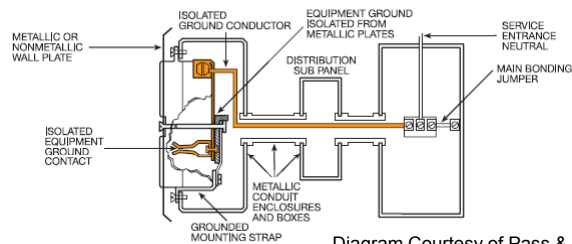
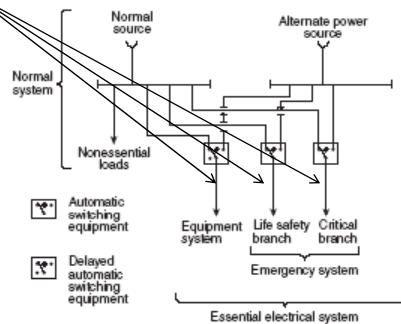


Diagram Courtesy of Pass & Seymour

517.17(B) – Feeders (Ground Fault Protection)

- Now clarifies that the prohibition of 2nd level of ground fault is only on the load side of an essential system transfer switch.
- 2nd levels of GFPE are permitted elsewhere in the essential system
 - Can help with coordination
 - Article 700 does not prohibit GFPE on emergency system



517.17(C) - Selectivity

- Deleted the 6 cycles of separation for the GFPE selectivity
- Now requires:
 - Conformance to manufacturers recommendations
 - Consider all required tolerances and operating time to achieve 100% selectivity



547.5(G) – Agricultural Buildings - GFCI

- Exception to eliminate GFCI protection has been deleted
- All 125-volt, single-phase, 15- and 20-ampere general-purpose receptacles required to have GFCI protection:
 - Areas having an equipotential plane
 - Outdoors
 - Damp or wet locations
 - Dirt confinement areas for livestock



555.3 – Marinas - Ground Fault Protection

- Main overcurrent protective device feeding the marina:

- Required to have Ground Fault Protection of Equipment (GFPE)
- GFPE level shall not exceed 100mA
- GFPE protection of each individual feeder or branch circuit is permitted as an alternative



- GFCI protection still required for receptacles in accordance with 555.19(B)(1)

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65

590.6(A)(3) – Receptacles on 15KW or less Portable Generator

- All 125- and 125/250- volt, single-phase, 15-20-, and 30-ampere receptacle outlets, shall have GFCI protection on the generator

- Challenges

- Installing GFCI on the generator means that the neutral of the generator will be bonded
- Bonding the neutral creates issues for transfer equipment that does not switch the neutral because neutral would now be bonded downstream of the service disconnect
- Will now need transfer equipment that switches the neutral if intended to be used with a portable generator



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66

600.33 LED Signs

- New provisions governing the wiring method and materials for light-emitting diode (LED) type sign systems have been added to Article 600
- Clear and concise requirements for Class 2 LED circuits are needed for electric signs and outline lighting
- LED lighting systems have become an increasingly popular light source over the past decade or so
- This new section is designed to consolidate the majority of the rules for Class 2 power limited wiring used in signs and outline lighting into Article 600

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67

600.33 LED Signs

600.33 LED Sign Illumination Systems, Secondary Wiring *(Electric Signs and Outline Lighting)*

The wiring methods and materials shall be installed in accordance with the sign manufacturer's installation instructions using any applicable wiring methods from Chapter 3 and the requirements for Class 2 circuits contained in Part III of Article 725.

(A) Insulation and Sizing of Class 2 Conductors

(B) Installation

(C) Protection Against Physical Damage

(D) Grounding and Bonding

(See NEC for complete text)

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68

625.2 – Definitions

● Electric Vehicle now includes

- Electric motorcycles
- Plug-in hybrid electric vehicles



● Plug-in Hybrid Electric Vehicle (PHEV)

- A hybrid vehicle intended for on-road use with the ability to store and use off-vehicle electrical energy in the rechargeable energy storage system and has a second source of motive power

● Rechargeable Energy Storage System

- A power source that can be charged and discharged.
 - Examples include batteries, capacitors, and electromechanical flywheels



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69

645.2 – Definitions (ITE)

● Critical Operations Data System

- requires continuous operation for the reasons of public safety, emergency management, national security, or business continuity

● Zone

- A physically identifiable area (such as barriers or separation by distance) within an information technology equipment room with dedicated power and cooling systems for the information technology equipment or systems.



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70

645.10 – Disconnecting Means

●(A) Remote Disconnect Controls

- Allows Emergency Power Off actuator to be located in an approved alternative location (rather than at principal exit doors)

●(D) Critical Operations Data Centers are not required to have remote disconnect controls where:

- Approved procedure
- Qualified personnel continuously available to meet emergency responders
- Fire detection and suppression systems
- Cables installed under a raised floor, other than branch circuit wiring and power cords installed in compliance with 645.5(D)(2) or (3), are in compliance with 300.22(C), 725.154(A), 770.154(A), or 800.154(A).

645.25 – Engineering Supervision

●Feeder and service load calculations for new or existing loads shall be permitted by a licensed and qualified professional engineer

- Feeders shall not be required to be of greater ampacity than the service conductors.
- Service or feeder conductors shall be permitted to have neutral load determined by 220.61.



670.5 – Short Circuit Current Rating

- Industrial machinery is not permitted to be installed where it does not have a short circuit current rating adequate for the available fault current
- Short-circuit current rating for the machinery is required by 670.3(A)(4).



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73

680.2 – Low Voltage Contact Limit

- A voltage not exceeding the following values:
 - (1) 15 volts (RMS) for sinusoidal ac
 - (2) 21.2 volts peak for nonsinusoidal ac
 - (3) 30 volts for continuous dc
 - (4) 12.4 volts peak for dc that is interrupted at a rate of 10 to 200 Hz.



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74

680.10 – Underground Wiring Locations – Minimum Cover Depths

- Revises the minimum cover depth table to permit NM conduit buried under 4" thick concrete slab
- Conduit depth permitted to be 6 inches
- Concrete slab must extend at least 6" beyond area of underground installation

Wiring Method	Minimum Cover	
	mm	in.
Rigid metal conduit	150	6
Intermediate metal conduit	150	6
Nonmetallic raceways listed for direct burial under minimum of 102 mm (4 in.) thick concrete, exterior slab and extending not less than 162 mm (6 in.) beyond the underground installation.	150	6
Nonmetallic raceways listed for direct burial without concrete encasement	450	18
Other approved raceways*	450	18

*Raceways approved for burial only where concrete encased shall require a concrete envelope not less than 50 mm (2 in.) thick.

680.26(B)(7) – Equipotential Bonding

- Adds to the list of fixed metal parts that are required to be bonded around a pool:
 - Metal awnings
 - Metal fences
 - Metal door and window frames
 - Deletes the words “all metal parts” but now includes the words “including, but not limited to...”
- Exceptions remain for:
 - Parts separated by a permanent barrier
 - Parts more than 5 feet horizontally from the walls of the pool
 - Parts more than 12 feet vertically from maximum water level



680.43 Exception No. 2 - Indoor Installations

- Basic rule requires indoor installations of spas and hot tubs to comply with Parts I and II of Article 680
- Includes 680.26 for equipotential bonding
- Exception for spas and hot tubs that are:
 - Listed, self-contained units, and
 - Installed above the finished floor



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77

680.73 – Accessibility

- Adds a new sentence to require that cord and plug connected hydromassage tubs:

If supply receptacles are accessible only through a service access opening,

Receptacle must be installed such that its face is in direct view and not more than 12 inches from the opening



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78

690.4(B) – Identification and Grouping

- PV system conductors must be separated from conductors, feeders or branch circuits of non-PV systems:

- In raceways, cable tray, cable, outlet box, junction box or similar fitting
- Unless separated by partition

- PV system conductors shall be identified and grouped:

- By separate color coding, marking tape, tagging or other approved means
- PV source circuits, PV output circuits, Inverter input and output circuits
 - at all terminations, connections and splices
- Where there is more than one PV system in same box, raceway or equipment - each system must be identified



690.4(B) – Identification and Grouping

- (4) More than one PV system in a junction box or raceway with removable covers

- AC and DC conductors for each system shall be grouped separately by wire ties or similar means
- Must be grouped at least once and then at intervals not to exceed 6 feet



690.4(E) – Wiring and Connections

- Requires that PV systems and all associated wiring and interconnections shall be installed only by qualified persons
- Article 100 – Qualified Person
 - One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training to recognize and avoid the hazards involved.



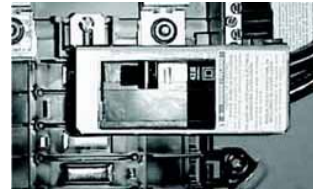
690.4(H) – Multiple Inverters

- Permits multiple utility-interactive inverters in or on a single building or structure
- Where remotely located from each other, a directory denoting all power sources on or in the premises at:
 - Each DC PV system disconnecting means
 - Each AC disconnecting means
 - Main service disconnecting means showing the location of all AC and DC PV system disconnecting means
- Exception where all inverters and PV dc disconnecting means are grouped at the main service disconnecting means.



690.10(E) – Backfed Circuit Breakers

- Plug-in backfed breakers are now required to be secured per 408.36(D). Previous allowance to omit for PV has been removed.
- 408.36(D) Backfed plug-in breakers must have an additional fastener that requires other than a pull to release the device from the mounting means on the panel



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83

690.11 – Arc-Fault Circuit Protection (DC) – PV Systems

- Required for:
 - dc source and/or output circuits located on or penetrating a building and operating at a PV system maximum voltage of 80 V or greater
- Listed (dc) AFCI, PV type or other system listed to provide the protection
- Must detect and interrupt arcing faults
 - Failure of intended continuity of conductor, connection, module or other DC source component
- Must disable or disconnect one of the following:
 - Inverters or charge controllers in the faulted circuit
 - System components within the arcing circuit



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84

NEC 694 – Small Wind Electric Systems

●694.1 - Scope

- Small wind (turbine) electric systems
- One or more wind electric generators
- Individual generators rated power up to and including 100kW
- Covers stand alone or interactive systems



●694.10 – Maximum Voltage

- One and two family dwellings – turbine output voltage limited to 600V max
- Over 600V permitted for other installations



●694.22(C)(1) – Disconnect Location

- On or adjacent to the turbine, OR
- Outside building or structure or inside at point of entrance

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85

695.3 – Fire Pump Power Source(s)

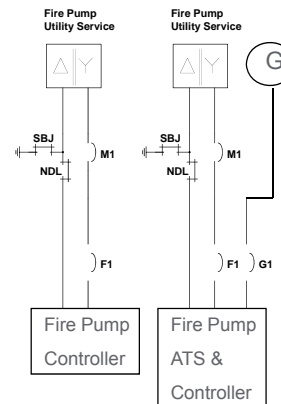
●Article 695 reorganized for clarity

●Individual Sources

- 695.3(A)(3) – Dedicated feeder derived from a 695.3(A)(1) service connection is permitted

●Multiple Sources

- 695.3(B)(2) – clearly allows a 695.3(A) source and generator to serve as a power source
- 695.3(C)(2) clarify that an individual/dedicated feeder source and alternate source/on-site standby generator are permitted for multi-building campus style installations



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86

695.4(B)(3) – Disconnecting Means – Features and Location – Onsite Standby Generator

- Disconnecting means for the generator must be installed to meet 700.10(B)(5) for emergency circuits
- 700.10(B)(5) requires that emergency, legally required and optional standby loads be supplied from separate enclosure or from separate switchboard sections



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87

700.10(D)(1) – Fire Protection (emergency feeders)

- Fire rating requirements increased from 1 hr to 2 hrs
- Feeders must protected by:
 - Being installed in spaces fully protected by fire suppression
 - Listed electrical circuit protective system with a minimum of 2 hr rating
 - Listed thermal barrier system with minimum 2 hr rating
 - Listed fire-rated assembly that has a minimum 2 hr rating
 - Being encased in 2" of concrete



Assembly occupancies 1000 persons or greater

Buildings over 75' – assembly, educational, residential, detention/correctional, business, mercantile

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88

701.6(D) – Signals - Ground Fault (legally required systems)

- Ground fault indication required
701.26
- Audible and visual signal devices for ground faults indication



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89

Additional Resources

- Schneider Electric Codes and Standards Website

www.schneider-electric.us/go/codes

- Electrical Shortz
- InfoZone
- Electrical Inspector Resource Area
- Articles and Publications

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90

About the Instructor



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